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SPECIAL NOTICE

A compilation of the summary portions of the Research and Technology Objectives and Plans *(RTOPS)* used for management and control of research currently in progress throughout NASA has been published under the title *Research Technology Objectives and Plans Summary, Fiscal Year 1980*. It is announced as accession number N80-15974, NASA-TM-80744, on page 810 of this issue of *STAR*.

RTOP SUMMARY FY1980, also should help expedite the NASA program of technology transfer to the private sector.

RTOP SUMMARY FY1980 may be purchased from the National Technical Information Service, Springfield, Virginia, 22161, for $9.25 in paper copy or $3.50 in microfiche. (The cost for customers outside the United States is $18.50). The accession number N80-15974 (NASA-TM-80744) should be specified when ordering this publication.

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By arrangement between NASA and the Smithsonian Science Information Exchange (SSIE), a separate section of information on aerospace-related *On-Going Research Projects* is inserted into each issue of *STAR*. The insert presents titles of active NASA grants and university contracts, summary portions of recently updated *NASA Research and Technology Objectives and Plans (RTOPs)*, and notices of non-NASA research projects that were funded in the most recent or current fiscal year. The latter are selected by SSIE. The project announcements in the insert are arranged by *STAR* divisions but are otherwise entirely separate from *STAR*. They are not indexed nor machine-searchable by NASA. Current and retrospective searches are available from SSIE, 1730 M Street, N.W., Washington, D.C. 20036.

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Subject scope of *STAR*, *IAA*, and *On-Going Research Projects* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general), aerodynamics, air transportation and safety, aircraft communications and navigation, aircraft design, testing and performance, aircraft instrumentation, aircraft propulsion and power, aircraft stability and control, and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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VOLUME 18 NUMBER 6/MARCH 23, 1980

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 689

02 AERODYNAMICS 689

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 693

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 693

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 694

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 696

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 696

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

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Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 709

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For related information see also *14 Ground Support Systems and Facilities (Space)*.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 710

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 710

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 711

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 711

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION N.A.

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 712

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION **N.A.**

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER **712**

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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23 CHEMISTRY AND MATERIALS (GENERAL) **N.A.**

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS **713**

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY **714**

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS **716**

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS **721**

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **722**

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) **725**

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **726**

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING **729**

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER **733**

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY **735**

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS **736**

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING **739**

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY **740**

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **741**

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

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Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) **744**

43 EARTH RESOURCES 744
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 757
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 768
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 775
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 778
Includes weather forecasting and modification.

48 OCEANOGRAPHY 784
Includes biological, dynamic and physical oceanography; and marine resources.

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51 LIFE SCIENCES (GENERAL) 785
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52 AEROSPACE MEDICINE 786
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53 BEHAVIORAL SCIENCES 790
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

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60 COMPUTER OPERATIONS AND HARDWARE 791
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 792
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS N.A.
Includes computer networks.

63 CYBERNETICS 794
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 795
Includes iteration, difference equations, and numerical approximation.

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66 SYSTEMS ANALYSIS 796
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For related information see also *Engineering*.

70 PHYSICS (GENERAL) N.A.
For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 797
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 798
Includes atomic structure and molecular spectra.

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Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 803
Includes light phenomena.

75 PLASMA PHYSICS 804
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 806
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 809
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 810
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 811
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 812
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 812
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 812
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 814
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS N.A.
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 814
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 815
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION N.A.
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

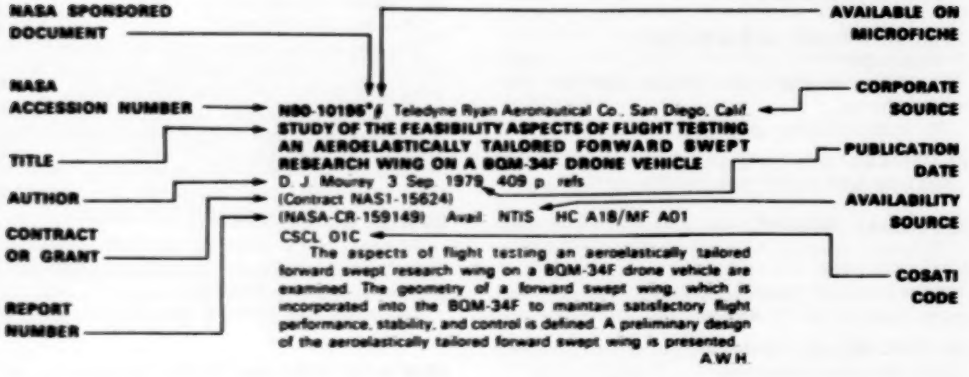
GENERAL

99 GENERAL 816

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-49
CORPORATE SOURCE INDEX I-57
CONTRACT NUMBER INDEX I-69
REPORT/ACCESSION NUMBER INDEX I-73

TYPICAL CITATION AND ABSTRACT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N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mourey 3 Sep. 1979 409 p refs
(Contract NAS1-15624)
(NASA-CR-159149) Avail: NTIS HC A18/MF A01
CSCL 01C
The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, NAVY ENVIRONMENT - TRI-TURBO PROP AIRCRAFT

B.M. Buck, Polar Research Lab. Inc., *123 Santa Barbara St., Santa Barbara, California* 93101 (DN975107; N00014-79-C-0002)

In response to the 5 year arctic planning guide AD OPNAV Inst. S3470.5, the arctic research program is shifting from the western arctic to the eastern arctic. This redirection requires a change in the traditional reliance on NARL and its fleet of short range aircraft. This proposal is to introduce the tri-turbo prop aircraft into use as a logistic support platform over a 3 year period from 1 March to 30 May.

This aircraft would be, as its capabilities are demonstrated, folded into the logistic support plans for FRAM I, subsequent field efforts in FY 80-85. The funds provided would configure the aircraft for polar operations including specialized land gear equipment, navigation and communications equipment and a cold weather package. The funds would provide about 270 flight hours per year over the three year period.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0002, INVESTIGATION OF TIME-VARIANT AERODYNAMICS OF HIGH TURNING BLADE ELEMENTS

S. Fleeter, General Motors Corp., Detroit Diesel Allison Division, *4700 W. 10th St., Indianapolis, Indiana* 46206 (DN890143; N00019-79-C-0087)

To obtain fundamental experimental data on unsteady aerodynamic phenomena in high inlet Mach number, large turning, turbine rotor cascade.

Fundamental data will be obtained at each of four operating points, such that both subsonic and transonic flow regimes are investigated. This data will include the blade surface steady-state, quasi-static and time-variant pressure distributions as well as the cascade steady state aerodynamic performance. All of the data obtained will be correlated with appropriate state-of-the-art predictions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0003, FRETTING FATIGUE IN THE PRESENCE OF OVERLOADS

J. Alic, Wichita State University, School of Engineering, Dept. of Mechanical Engineering, *1845 Fairmont N., Wichita, Kansas* 67208 (DF140960; AFOSR-77-3422)

Structural safety of USAF aircraft is a continuing problem. To insure that prescribed levels of safety are achieved, methods must be developed to account for crack initiation at latent damage sites. The objective of this study is to explore the applicability of equivalent initial quality (EIQ) concepts for modeling fretting fatigue initiated crack damage. These methods will lead to improved crack growth analyses providing increased safety and reduced cost of ownership for USAF aircraft.

The basic procedure will be to experimentally investigate the influence of load interaction on fretting fatigue. This will be accomplished by concentrating on the possible effects of residual stress fields at localized stress concentrations such as crack nuclei and microcracks. Fretting fatigue tests will be conducted with periodic tensile or compressive half-cycles of large load amplitude (overloads) spaced throughout an otherwise constant amplitude load sequence. The results will be compared with constant amplitude tests (without overloads). Quantitative information on crack growth rates as well as the apparent or equivalent initial flaw size of fretting damage will be acquired and presented in forms usable in design analyses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, VATOL FIGHTER STUDY

C. Martin, U.S. Dept. of Defense, Navy, Naval Ship Research & Development Center, Aviation & Surface Effects Dept., *Bethesda, Maryland* 20084 (DN878681)

To quantify the pilot performance required to fly vertical attitude takeoff and land (VATOL) aircraft, and the performance potential of this type aircraft in fighter/attack missions.

3-DOF and 6-DOF simulations will be made of the control system in the critical takeoff and landing modes. Performance predictions of conceptual aircraft will be made. Preparations for 6-DOF, moving base simulation will be made.

SUPPORTED BY U.S. Dept. of Defense, Navy, David W. Taylor Naval Ship Research & Development Center

1.0005, AN EXPERIMENTAL AND ANALYTICAL STUDY OF HELICOPTER AERODYNAMICS IN GROUND EFFECT 16061-E

H.C. Curtiss, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Sciences, *Box 430, Princeton, New Jersey* 08540 (DA0F9283; DAAG29-78-G-0194)

To investigate the aerodynamics of rotors in ground effect with particular emphasis on the influence of ground proximity on stability and control of helicopters. Relevance - the research is directly relevant to improving the stability and control of Army helicopters operating in the nap-of-the-earth environment.

An isolated helicopter rotor moving over a fixed ground plane in the Princeton Dynamic Model Track facility will be employed for the experimental investigations. Experimental measurements will include forces and moments acting on an isolated rotor in and out of ground effect, and surveys of the average air flow velocities in the rotor wake. Results will be analyzed and correlated with theory.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0006, FORWARD SWEPT WING V/STOL AIRCRAFT STUDY

D. Migdal, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890210; N00019-79-C-0435)

Recent developments in composite structures technology have indicated that it should be feasible to develop a forward swept wing of comparable weight as an equivalent aft swept

wing. Analysis and wind tunnel tests have shown the forward swept wing to have lower transonic drag, greater maneuverability and high natural spin resistance when compared with a conventional aft swept wing. In addition, the forward swept wing appears to offer added advantages for V/STOL applications. The objective of this work is to document the benefits of the forward swept wing concept applied to fighter/attack V/STOL aircraft.

The advantages of the forward swept wing concept will be evaluated initially through preliminary design studies, followed by small scale tests to determine suckdown losses (or gains) and control effectiveness using vanes in the jet blast. A preliminary simulator investigation of the estimated flying qualities, particularly with regard to translational/rotational coupling, will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0007, ACTUATION SUBSYSTEM EFFECTIVENESS ENHANCEMENT
G.D. Jenney, Dynamic Controls Inc., *Dayton, Ohio* (DF139940; F33615-77-C-3077)

Actuation subsystems now contribute over 50 percent of the total cost of the flight control system and account for a large share of the logistics support requirements of military aircraft. The objective is to reduce the flight control initial and life cycle costs by developing less complex systems more suitable for universal applications, developing lower cost component parts and developing criteria for increased commonality. Simpler componentry and modularization will reduce acquisition and life cycle costs. Particular emphasis shall be applied to the development of a basic 'fly-by-wire' redundancy scheme of superior performance for general application. The resulting 'predesigned' systems shall be optimized to exhibit improved reliability and maintainability. Matching the performance requirements of the aircraft with the control surface actuators will eliminate oversizing of actuators or sacrificing of performance at key portions of the flight envelope.

Investigate and develop techniques to simplify or eliminate major subassemblies, to promote modularization of actuators, to reduce component complexity and cost and to perform required functions (e.g. position and rate sensing) via alternate methods. Demonstrate the application of higher bandwidth actuators, investigate improved interfacing techniques, alternate redundancy schemes and methods for reducing life cycle costs for flight control systems. Set up and conduct evaluation tests, in the flight control actuation and hydraulic facility located in Building 145, Wright-Patterson AFB, on equipment such as integrated actuator package and integrated valve-actuator assemblies. In addition, wind tunnel test a flutter suppression actuator to evaluate advanced actuation equipment developed during a prior program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, ANALYSIS DEVELOPMENT FOR DYNAMICS DATA REDUCTION
P.G. Bolds, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF139060)

This work unit supports the functions of the vibration and aeroelasticity facility for providing analysis of dynamics data. The broad problem is to provide state-of-the-art capabilities required for the recovery, analysis, and presentation of dynamics data which describe the operating environment of military flight vehicles and assess the accuracy of analytical prediction methods. The objective of this work unit is to integrate hardware to increase data recovery capabilities and to develop software for the analysis system that will advance the existing analysis and graphics capabilities. This will result in improved performance and advanced capabilities in the analysis of vibration and acoustic problems that occur during military operations.

The dynamics data analysis process consists of four parts: (1) data recovery and analog analysis, (2) analog-to-digital conversion, (3) digital analysis, and (4) graphic data presentation. The capabilities in the data recovery and A/D conversion areas will be increased by optimizing and upgrading the existing system components and by integrating new hardware into the system. The data analysis and graphics capabilities will be advanced by developing software and digital processing techniques to apply more sophisticated analysis procedures and to provide more graphic data presentation formats to increase the overall interpretability of the analysis results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, HELICOPTER LIFE MONITORING FEASIBILITY BENEFITS ANALYSIS
Unknown, Boeing Co., Vertol Division, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DN890159; N00019-79-C-0069)

Identify the utility of in-service fatigue monitoring of Navy/Marine helicopters to acquire information concerning life expenditure of critical rotating and non-rotating components.

A study will be made up to evaluate the feasibility of life monitoring systems to gather information on the rate-of-damage-accumulation of critical structural and dynamic components based upon designed service information available for H-46 helicopters. Components suitable for direct and transfer function monitoring will be identified and a benefits/costs analysis will be conducted for various monitoring approaches.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0010, REPEATED ACCELERATION EXPOSURE EFFECTS
E. Hendler, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881086)

To determine the psychophysiological effects of repeated exposures to acceleration loads, as applied by the dynamic flight simulator (DFS) to volunteer human subjects.

Volunteer subjects shall be repeatedly exposed to predetermined levels, patterns and durations of acceleration loads using the DFS. Time between successive exposures shall vary from fractions of a minute to hours. Exposures shall be made on relaxed subjects as well as on subjects protected from acceleration effects (i.e. through the use of the anti-g suit M1 starting maneuver and reclined seat). Physiological and performance measures as well as clinical assessments shall be made before, during and after acceleration exposures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, PAN PRECURSOR - CARBON FIBER STRUCTURE RELATIONS
W.C. Tincher, Georgia Inst. of Technology, School of Textile Engineering, *Atlanta, Georgia* 30332 (DN975478; N00014-79-C-0523)

Carbon fibers with increased tensile strength, increased strain to failure, and decreased electrical conductivity are required for use in advanced aerospace systems such as nose tips, rocket nozzles, and carbon fiber reinforced composites used in military aircraft. To date there has been little systematic study of the influence of the composition and microstructure of the acrylic precursor fiber on the ultimate carbon fiber properties. Because the microstructure of the precursor fiber depends upon chemical composition, molecular weight, spinning conditions, and post-spinning treatments, a study will be undertaken to determine which parameters of the precursor fiber control the properties of the ultimate carbon fiber in order to permit fibers to be produced with improved properties at lower cost.

The Georgia Institute of Technology has equipment available to prepare the precursor polymer, spin fibers, stabilize the fibers, and carbonize the fibers. Facilities will be added to be able to graphitize the fibers. Comonomer type, copolymer composition, microstructure developed in fiber extrusion, and precursion orientation will be related to carbon fiber structure,

morphology, modulus strain to failure, tensile strength, and electrical conductivity. A team of four faculty members will combine their special talents, namely, polymer production, acrylic fiber spinning, carbon fiber processing, and microstructural characterization, to determine how precursor properties relate to the ultimate carbon fiber properties.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0002, ADVANCED AIRCRAFT STRUCTURAL SKINS
T.V. Hynes, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0H4679)

Previous research has evolved designs for lightweight/high strength skins which address a multiplicity of actual and potential blast, ballistic, radar and high-energy laser threats. This work unit will develop a specific design to meet the mechanical load requirements of the system and integrate specified levels of laser protection and significant levels of radar levels of radar camouflage. Designs will be fabricated and tested in panel configuration.

Mechanical requirements will be specified and an initial composite design developed based on the generic designs previously tested. An electrical design compatible with the mechanical configuration will be developed and the design relased to allow radar bandwidth and attenuation to be optimized. An improved mechanical design to meet flight load specifications and a second iteration of the design to re-optimize the radar properties will be made. The mechanical design will be constrained to be compatible with blast and ballistic protection. Materials will be chosen for high energy laser resistance.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0003, NAVY VEHICLE DESIGN AND CONSTRUCTION - RARE EARTH ADDITIONS TO TITANIUM ALLOYS
C.R. Whitsett, McDonnell Douglas Corp., Research Laboratory, *P.O. Box 516, St. Louis, Missouri* 63166 (DN675493; N00014-76-C-0626)

Titanium alloys are important lightweight structural materials for use in aircraft and ships. Alloy microstructure and mechanical properties can be controlled by effective use of alloying and processing. This research will explore the effects of rare-earth additions to titanium alloys.

The effects of rare earth additions to Ti-8Al, Ti-10Al and Ti-100 alloys will be determined. Erbium and yttrium additions (0 to 0.5 wt. percent) will be introduced to the alloys and structural changes correlated with mechanical properties, particularly tensile strength and ductility, toughness, hot workability, and creep strength.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0004, THE EFFECT OF PHOSPHORUS ON THE DEVELOPMENT OF THE STRUCTURE OF IRON METEORITES
J.I. Goldstein, Lehigh University, School of Engineering & Physical Science, Dept. of Metallurgy & Materials Science, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (EAR79-00995)

The major objective of this research is to measure the diffusion coefficients and solubility limits in the Fe-Ni and Fe-Ni-P system at temperatures less than 600 degrees C. STEM techniques will be used to obtain the compositions of the various phases which are less than 1 micron in size. These measured parameters will be used to understand the growth patterns of the Widmanstatten structure in iron meteorites. The second part of the research will try to experimentally grow the Widmanstatten pattern in P containing Fe-Ni alloys. A comparison of the composition gradients with calculated gradients using the computer simulation programs should establish the validity of the calculation scheme and should give a clearer picture as to how the Widmanstatten pattern forms during the slow cooling of the iron meteorites in their parent body.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, TURBULENCE STRUCTURE IN COMPLEX HEATED FLOWS
D.M. McEligot, University of Arizona, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Tucson, Arizona* 85721 (ENG79-07806)

Experimental and numerical studies of complex turbulent and transitional flows are conducted. Three situations are examined: (1) vertical air flow through a circular tube with strong heating, (2) a radially converging flow of water or air between two parallel plates, and (3) periodic, recirculating flow between baffles. The goal is to develop the ability to predict mean temperature and velocity profiles and wall parameters, such as heat transfer coefficients and friction factors, reliably in turbulent and transitional flows subject to the following important complications: interacting shear layers, lateral convergence, buoyancy or streamline curvature, longitudinal acceleration and severe variation of molecular transport properties. Time-mean distributions of the velocities, temperature, Reynolds shear stress and turbulence heat flux are measured with hot wire anemometry, laser Doppler anemometry and resistance thermometry in conjunction with digital data acquisition. The wall region and its viscous (buffer) layer are emphasized. These data are compared to existing turbulent predictive methods and documented to serve as useful tests of advances in turbulence models hypothesized later.

This research continues work carried out under NSF Grant No. ENG-7303513.A03.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0002, VORTICITY MEASUREMENTS IN TURBULENT SHEAR FLOW
P.E. Dimotakis, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (ENG7810246)

A single component vorticity measuring device, using Laser Doppler velocimetry techniques will be developed and utilized to make preliminary vorticity measurements of coherent structure in turbulent free shear layers. An understanding of the dynamics and entrainment characteristic of such flows can contribute to advances in combustion engineering and jet noise reduction.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0003, SEMICONDUCTOR OPTOELECTRONICS
A. Yariv, California Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Applied Physics, *1201 E. California Blvd., Pasadena, California* 91109 (ENG79-09972)

The goal of this research program is the realization of integrated optoelectronics for use in high speed, terrestrial optical communication systems. Toward achieving this goal, the following tasks are being pursued: (1) Monolithic integrated optoelectronic circuits on semi-insulating gallium arsenide; (2) The behavior of semiconductor injection lasers under conditions of direct modulation in the multi-gigahertz regime; (3) New laser configurations on semi-insulating substrates; (4) Quaternary alloy photodiodes in the 1.1-1.3 micron range; (5) Fabrication of microwave quatenary alloy amplifiers.

This research was previously supported under NSF Grant ENG76-04927 AO3.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0004, INVESTIGATION TO DETERMINE THE FEASIBILITY OF APPLYING THE SMIDS CONCEPT TO THE M-65 TOW GUIDED MISSILE ARMAMENT SUBSYSTEM
R. Depaul, Detex Systems Inc., *17871 Santiago Blvd., Villa Pk. Suite 221, Orange, California* 92667 (DA0E3865; DAAK51 79 C 0013)

The objective of this study is to determine the feasibility of applying the SMIDS concept to the maintenance of the M-65 tow missile subsystem of the AH-1S aircraft.

This objective will be accomplished by a detailed study of the functional elements of the M-65 subsystem and by describing the maintenance procedures of these elements at the three levels of maintenance now used in the Army system. A determination as to the feasibility of applying SMIDS at these levels will then be made.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

4.0005, Q BAND 250W TRAVELING WAVE TUBE DEVELOPMENT
J. Vaszari, Hughes Aircraft Co., *3100 W. Lomita Blvd., Torrance, California* 90509 (DN987685; N00123-77-C-0900)

Develop a Q band 250 watt traveling wave tube (TWT) for use as a transmitter for EHF SATCOM systems. This contract supports dn988682.

Design and fabricate six TWT's with design iterations for each two tubes. Perform life and environmental tests on two tubes.

SUPPORTED BY U.S. Dept. of Defense, Naval Ocean Systems Center, Electronics Engineering & Sciences Dept.

4.0006, FLAT BUS FAULT SENSORS
E. Young, Rockwell International Corp., Autonetics Division, *3370 Miraloma Ave., Anaheim, California* 92803 (DN981064; N62269-78-C-0213)

To investigate and develop an electric power distribution fault sensing technique for use on the 270 v dc two wire ungrounded power distribution system for operation in composite aircraft structures. This contract supports work unit ZA601, Agency Accession No. DN681080.

To study system hazards of lightning, EMP radiation and electric system faults to establish an operational philosophy for the 270 v dc system for operation in composite aircraft structures. With this operational philosophy investigate and develop fault sensors for use on the electric power system utilizing flat bus electric power conductors.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0007, DISTRIBUTED AIRBORNE INFORMATION PROCESSING SYSTEMS ARCHITECTURE
H.F. Wong, U.S. Dept. of Defense, Navy, Naval Electronics Lab. Center, Communication Processing Div., *San Diego, California* 92152 (DN787559)

Investigate the problem of control for a distributed information processing architecture which can readily adapt to and recover from hardware failures.

Review latest distributed processing architecture advances. Update the distributed architecture design developed by NELC and UCLA. A distributed processing laboratory model will be implemented for detailed investigations of distributed control, fault detection and system recovery techniques. An airborne application will be investigated for possible implementation with the laboratory model.

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0008, SYSTEM PERFORMANCE
K. Yao, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Systems Science, *405 Hilgard Ave., Los Angeles, California* 90024 (DN675573; N00014-76-C-0875)

The objective of this project will be to develop analytic methods to measure and predict the reliability of naval communications links.

The technical approach is theoretical and analytical with experimental validation of the performance measures and predictions. Analytical results obtained for several specific systems characteristics will be extended to nonlinear satellite systems, noncoherent detection systems, and the robustness of the technique will be evaluated by testing the results in the presence of non-Gaussian noise. The mathematical tractability of the moment-space error bounding technique will be evaluated as well as the adaptability of the technique to shift its own parameters in real time to optimize the signal to noise ratio on the link.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, CARS INVESTIGATIONS IN TURBULENT, SOOTING FLAMES
A.C. Eckbreth, United Technologies Corp., Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DN975394; N00014-79-C-0351)

The objective of this research program is the development of a remote, spatially precise, in-situ diagnostic technique capable of measuring temperature probability distributions over a broad range of combustor operating conditions. The polarization properties of coherent anti-Stokes Raman spectroscopy (CARS) is under investigation in an attempt to reduce or cancel the nonresonant susceptibility contributions to the CARS signal which limit species detectability levels. This information is needed to enhance modeling theories and to provide understanding necessary for improved empirical engine design procedures, combustion efficiency, and component lifetime and to reduce pollutant formation in jet engines.

Currently, experiments are being conducted with CARS utilizing sooting flames. To eliminate possible complications from turbulence, steady laminar flames are utilized. Following this, studies will be extended to unsteady, turbulent sooting flames.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, WEAPONRY - TURBULENT STRUCTURE DETERMINATION BY RAMANOGRAPH
R.K. Chang, Yale University, Graduate School, Dept. of Engineering Science, *206 Elm, New Haven, Connecticut* 06520 (DN975315; N00014-79-C-0254)

The objective of this work is to investigate by Ramanography, (1) the species concentration profile of reactive and nonreactive gases emerging from well characterized nozzles under turbulent and nonturbulent conditions, (2) develop pulsed Ramanography for instantaneous studies on large scale structures and entrainment in the turbulent mixing layer, and (3) measure the instantaneous temperature of combustion flames under equilibrium and nonequilibrium conditions. This experimental data on well characterized nozzles and new measurement techniques is needed for the study of combustors, turbine and nozzle entry flows, and engine exhaust flows, all to provide understanding to enhance future design of jet engines.

Raman and MIE scattering will be detected by a low light level TV camera to obtain instantaneous and simultaneous recording of concentration profile.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0011, NETWORK STUDY FOR INTRA-TASK FORCE COMMUNICATIONS
N. Kyriakipoulos, George Washington University, School of Engineering & Applied Sciences, Dept. of Engineering, *725 23rd*

St. N.W., Washington, District of Columbia 20037 (DN880377; N00173-78-RQ-07134)

To investigate two new multiple access schemes for applicability to intra-task force networking. Compare each scheme with standard multiple access schemes.

Among the various multiple access schemes used or considered in packet radio and satellite communications at least two have been developed to fit the special requirements of naval intra-task force communication networks. These two are the stochastic TDMA (STDMA) and the interleaved-frame reservation-contention (IFRC) schemes. The analysis of these schemes has progressed considerably. The purpose of this task is to evaluate the performance of these two schemes and compare each to the performance of standard/multiple access schemes such as TDMA and slotted ALOHA, and their variants. Since the analysis is primarily based on Poisson user statistics, a simulation study will be performed on the robustness of the performance of the different schemes relative to the Poisson assumption.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0012, ADVANCED TECHNIQUES IN ORBIT DETERMINATION

B. Kaufman, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980002)

The purpose of this effort is to apply advanced techniques in celestial mechanics to the problems of accurately determining and predicting satellite orbits. These methods will be incorporated into an orbit determination program capable of accurately and rapidly determining the orbit from observational data. The techniques to be developed appear to offer the high accuracy of numerical approaches. The computational speeds approach those of analytical methods and provide great flexibility in physical modelling.

The approach to be utilized in this effort is that of the method of averaging which is a semi-analytical method. Analytical single averaging will be used to eliminate the short period terms in the disturbing function. The equations of motion will then be numerically integrated. The averaging will allow the integration to use much larger step sizes thereby greatly increasing the speed. Recovery of the short period terms will be done in a recursive mannner to obtain the desired accuracy. Formulation of the disturbing forces due to drag, asphericity of the earth and third body disturbances will be investigated in order to obtain the optimum formulation for speed and accuracy. The choice of a numerical integration program will be made based on the characteristics of the equations of motion in order to obtain a method that is best suited to the large step size that will be used. A matching interpolator will be used to obtain the solution at intermediate times.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0013, RADIATION HARDENING OF POWER SYSTEMS

R.L. Statler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980059)

The objective is to develop the technology for improved, hardened primary power systems for remote military applications such as earth-orbiting satellites and strategic and tactical applications relating to surveillance, communication, and weapon systems. The near term objectives are to compare technical advantages and limitations of state-of-the-art non-fossil fuel power sources, such as radioisotope thermal generators, thermal electric and photovoltaic. The hardness of these energy sources will be assessed for particle and gamma radiation environments.

Comparative parametric studies of various state-of-the-art power sources will be made in connection with specific operating environments, including space and terrestrial. Limitations in the adaptation or utilization of power source options will be determined. Data from unattended prolonged operation will be analyzed. Radiation hardness of power source materials will be investigated by analysis and experimental investigation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0014, THEORETICAL ANALYSIS OF AFTERBODY DRAG OF ROCKETS DURING BALLISTIC (UNPOWERED) FLIGHT PHASES

H.H. Korst, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical & Industrial Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

The approximate method of sequential centered expansion is utilized to establish the inviscid supersonic flow field past axisymmetric forces and afterbodies including the slipstream configuration along the near wake. Special attention is given to viscous jet mixing within the transitional (dual layer) shear region along the wake boundary and to the refinement of closure conditions involving the pressure rise near the end of the wake and the recirculating flow within the near wake. Solutions for the base pressure and overall afterbody drag are determined which include the effects of sting interference, base bleed, internal and external heat addition and external wake interference. Extensive computer programs have been developed which are utilized to evaluate the merits of this analysis through comparison with experimental data.

SUPPORTED BY University of Illinois

4.0015, UNSTEADY LIFTING SURFACE THEORY

J.E. Yates, Aeronautical Research Associates of Princeton Inc., *50 Washington Rd., Princeton, New Jersey* 08540 (DN675261; N00014-77-C-0616)

The development of accurate methods for the calculation of unsteady loads on wings is essential for the prediction of their response to gusts, and for the prediction of their aeroelastic behavior. The objective of this research is to extend inviscid unsteady aerodynamic theory for thin airfoils to include viscous effects at the trailing edge, and then to extend this result to three-dimensional wing theory.

Unsteady analyses for aerodynamic design have been based largely on inviscid linearized theories which incorporate Kutta condition modeling. This research is directed to the development of a thin, viscous airfoil theory to better describe the flow about airfoils and about wings in general. The equations of motion used in thin airfoil theory will be modified to include the viscous terms and a solution of the resulting equations sought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0016, STUDIES OF THE EQUATORIAL IONOSPHERE

D.T. Farley, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (ATM73-06598 A03)

This grant funds experimental and theoretical work on ionospheric irregularities and plasma instabilities. In particular, it funds: 1. a study of the neutral temperature and the east-west wind velocity in the electrojet region (i.e., around 100 km), using a recently installed multiple-beam antenna array and radar system at the Jicamarca, Peru, incoherent-scatter radar facility; 2. upgrading of the Jicamarca facility to allow more accurate measurements of the winds and temperatures; and 3. studies of equatorial spread F, and of the plasma instabilities responsible for the spread F. Completion of these studies will add significantly to our understanding of some of the processes at work in the atmosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

4.0017, SIGNIFICANCE OF LARGE SCATTER OF COMPOSITE PROPERTIES TO RELIABILITY OF AIRCRAFT STRUCTURES

P.C. Chou, Drexel University, School of Engineering, Dept. of Mechanical Engineering, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (DN981096; N62269-78-C-0267)

To assess the adequacy of current structural design practices based on experience with metallic structural materials to structures constructed of advanced composite materials. Develop guidelines for future design criteria and structural validation testing to insure the adequacy of composite aircraft structures. This contract supports work unit DG 602, Agency Accession No. DN 133126.

A statistical parametric study will be conducted for a hypothetical fleet of aircraft using typical composite strength properties. Certain critically flawed structural locations will be assumed to exist in each aircraft and different series parallel arrangements of these flaws will be considered. The number of aircraft failures will be calculated for different confidence levels.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0018, RESEARCH INITIATION - INSTABILITY MEASUREMENTS IN HIGH SPEED SUBSONIC JETS

G.L. Morrison, Texas A & M University, College Station Campus, School of Engineering, Dept. of Mechanical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (ENG79-08002)

The noise produced by a jet of air is one of the major noise problems confronting the United States at this time. To date, the most commonly used method to reduce noise has been the reduction of the exit velocity of the jet since the acoustic power output is proportional to U^8 (where U is the exit velocity of the jet). Therefore, other methods of noise control are being sought. These other methods have been, to a large extent, simply trial and error since the noise production mechanisms are not fully understood. It therefore appears that in order to more effectively reduce noise emissions with minimal economic costs and performance losses one must know the noise generation mechanism.

There are several theories which hypothesize that the large scale organized flow fluctuations (coherent structure) in the jet are of fundamental importance in the noise generation process for both subsonic and supersonic jets.

An experimental investigation will be carried out to examine coherent structure in high speed subsonic jets (0.7 less than or equal to M less than or equal to 0.9) and determine its role in the development of the flow field. Subsequent experiments will measure the noise radiated by the jet and determine the amount of noise radiated by the coherent structure and the manner in which it propagates away from the jet. From this information, the importance of the coherent structure in the production of jet noise may be determined.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0019, COMPUTATIONAL TRANSONICS

G.F. Carey, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: A program of research in transonic airfoil computations has been initiated and is directed both to the underlying theoretical formulation of this compressible flow problem and also practical computations. A variational principle suitable for finite element analysis of shockless transonic airfoils has been devised (to appear in Journal of Computational Methods in Engineering). A finite element program has been developed and numerical studies are now being conducted at low and moderate Mach numbers for full potential flows with small supercritical regions. Convergence studies at various Mach numbers are being explored, particularly at the higher mixed flow levels. Mr. Pan presented some preliminary studies and numerical results at the Southwest Graduate Student Symposium during March 1978.

SUPPORTED BY University of Texas

4.0020, MECHANICS OF TERRESTRIAL PENETRATOR

C.H. Yew, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

Although our country has sent astronauts to the moon and brought them home safely, and has soft-landed successfully spacecrafts on the surface of Mars, the most economical means for the future geological exploration of these planets appears to be the use of high speed terrestrial penetrators. The penetrator, equipped with proper soil property investigation package, can be dropped to the target area by some proper means. Since the penetrator approaches the target with a high velocity, it penetrates deeply into the target. The tail section of the penetrator can be so designed that it would separate from the body of the penetrator and be left on the surface of the target to be used as a signal transmitting and receiving station. Once the penetrator is in the soil, the onboard instrument can be instructed to perform the necessary experiments and to send the results to the remote monitoring station. In principle, a great many in situ experiments on the soil property can be performed if a group of penetrators can be dropped into the general area because, with proper design, the penetrators can be made to communicate with each other and thus to be used as a signal generator as well as a signal receiver in the soil proper experiment. By doing so, the terrestrial properties of the general area can be obtained. It should be pointed out here that since the penetrator penetrates deeply into the soil, the use of the penetrator provides a convenient means of obtaining the soil properties at a depth; and since the penetrator is situated deeply in the soil, it would be better protected than the surface instruments. The present research is to develop a method for estimating the magnitude of force exerted on the penetrator resulting from high speed impact.

SUPPORTED BY University of Texas

4.0021, EXPERIMENTAL DEFINITION OF TOP-MOUNTED INLET FLOW FIELDS

W.W. Rhoades, Vought Corp., Advanced Tech Center Inc, *P.O. Box 5907, Dallas, Texas* 75222 (DF139550; F33615-78-C-3003)

Recent investigations of technology development needs for future air-to-surface fighters suggest that combat survivability can be enhanced significantly by reducing radar cross-section. Top-mounted inlets can reduce radar visibility of aircraft. They also facilitate aircraft weight reduction and improved weapon integration. In order to generate top-mounted inlet design criteria, flow fields approaching the inlet must be known. The objective of this program is to generate flow field data typical of top-mounted inlet installations on air-to-surface aircraft.

Existing wind tunnel model hardware will be modified as necessary and tested from Mach 0.9 to 2.0 in the AEDC PWT 4T facility over a representative set of maneuver attitudes. The model will facilitate testing with variations of leading edge geometry and canopy-fuselage intersection in order to explore a variety of flow fields. A remotely actuated cone probe will be used to define inviscid flow properties on one side of the model while boundary layer rakes gather viscous data on the opposite side. The contractor will provide reduced data to USAF engineers who will analyze the data and present the results in a USAF report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, VIKING CARTOGRAPHY

H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-00988)

Publication of two controlled mosaics of the Chryse Planitia Region of Mars, which includes the area where the Viking 1 spacecraft landed, has completed the Viking landing site series of maps. Chryse Planitia, one of the lowest areas on Mars, ap-

pears to have been the cachement basin for several large martian channel systems.

The Sinuous Channel, Bahram Vallis, and smaller dendritic channels, Vedra and Maumee Valles, cut the highlands of Lunae Planum to the west of the Chryse lowland plain. The four largest martian channels, Ares, Tiu, Simud and Shalbatana Valles, rise in the southern highlands region south of these map areas. Notched mare ridges, tear-shaped 'islands', and braided and scoured areas, indicate that the surface has been modified by fluvial erosion near the landing site, which is as much as 300 km from the channel source areas.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0002, MARS STRATIGRAPHIC STUDIES
D.H. Scott, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02370)

Stratigraphic studies along the plains-highlands boundary will be continued in places where good quality Viking photos are available. The work will be extended to the north along the boundary between the lowland plains and mottled terrain which nearly encircles the planet above 55 degrees N latitude. Morphologic characteristics of the mottled terrain are not clearly distinguishable and Viking images may require special processing for the subdivision of this large unit into several lithologic categories. Stratigraphic correlations will be made between various rock units forming the lowland plains; these relationships will be compared with crater frequency distributions calculated for the individual units.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0003, MULTIWAVE AEROSOL LIDER
R. Schotland, University of Arizona, School of Liberal Arts, Dept. of Atmospheric Sciences, *Tucson, Arizona* 85721 (DN975354; N00014-79-C-0313)

If this atmospheric aerosol remote sensing system can be demonstrated, it will be possible to predict the effects of aerosols on naval electrooptical surveillance and weapon guidance systems.

Several different wavelength lidars will be used to show the feasibility of a remote sensing system to determine atmosphere particulate size distributions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0004, NAVY ENVIRONMENT - CONSULTING AND GUIDANCE FOR NORTH SEA REMOTE SENSING EXPERIMENT
O. Shemdin, (No Performing Organization Reported), *California* (DN875510; N00014-78-C-0438)

The objective of this effort is to insure the proper coordination and experimentation in the multinational North Sea Experiment so that we can derive the maximum new knowledge on coastal geography and shallow-water oceanography and on satellite application in maritime remote sensing from this total experiment.

Approximately eight nations with more than thirty groups will apply satellite data, instrumented aircraft, ships, buoys and measurements from three or two research platforms in the sea and from islands during two months in the fall of 1979. Dr. Shemdin, under this contract, will be tasked to conduct negotiations, by telephone, correspondence and travel (including overseas) for the preparation of this experiment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0005, REMOTE SENSING APPLICATIONS TO ALUNITE RESOURCES, NEVADA
R.P. Ashley, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9320-01941)

STATE TO WHICH PROJECT PERTAINS: Nevada.

The project objective is to develop a semiquantitative tool for mapping variations in total alunite/clay content in hydrothermally altered rocks, using aircraft scanner images for spectral bands at 1.6 and 2.2 microns. Field and laboratory spectral reflectance data and preliminary petrographic data show that the depth of absorption at 2.2 microns (measured by the ratio of bands at 1.6 and 2.2 microns) is proportional to the total amounts of these minerals present. The task remaining is to attempt, using additional petrographic and chemical data, to better quantify the relationship between reflectance characteristics and percentages of these minerals.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, MEASUREMENTS OF NATURAL RADIOCARBON
H.E. Suess, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (EAR78-15183)

This is a continuation of research previously supported by NSF grant EAR76-22623. The objectives of the research are (1) to determine the character of the secular variations of the atmospheric radiocarbon level in order to elucidate the causes of these variations, and (2) to establish the absolute radiocarbon time scale. Far reaching conclusions from this research can be expected concerning problems of climatology and the global carbon cycle. In the field of oceanography, investigation of banded corals will give information of upwelling conditions of the past. Also, determinations of sedimentation rates will be continued. Contributions to archaeological research include work on calibrated radiocarbon dating in general and the dating of Neolithic sites in particular.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0007, RESEARCH AIRBORNE
F.C. Frischknecht, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9780-00353)

A coil assembly for a ground-transmitter-airborne receiver EM system will be developed and installed in the tail boom of the survey's Fairchild Porter aircraft. Preliminary tests of the hybrid EM system will be made using components of an existing ground based ELF system. Scale model studies of the system will be carried out.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0008, THERMAL MODELING INVESTIGATIONS
K. Watson, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9790-01703)

To extend the theoretical thermal model to more complex geological situations including topographic and surface roughness effects, to develop the computer methodology for registration of aircraft images acquired at different times in diurnal cycle and to complete aircraft/scanner modifications for navigation, spectral response and multichannel digitizing.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0009, DISTRIBUTION OF LAVA FLOWS IN THE THARSIS REGION OF MARS
D.H. Scott, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *Box 25046 MS939, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9580-02358)

Geologic mapping of lava flows in the Tharsis region will be extended from Arsia Mons to those emanating from the other large volcanic centers including Pavonis, Ascraeus, and Olympus Montes. This mapping will cover parts of Lunae palus, Arcadia, Diacria, Amazonis, Memnonia, Phaethontis, and Coprates quadrangles. Crater distribution and thickness measurements

will be made for individual flows and their probable source vents determined. Work will be compiled on the new series subquadrangle maps at a scale of 1:2 million.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0010, CLOUD TOP TEMPERATURE MONITORING
O.H. Foehner, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *Federal Ctr., Mail Stop 913, Denver, Colorado* 80225 (E-0036)
STATES TO WHICH PROJECT PERTAINS: California and Nevada.

An objective wide area analysis of cloud top temperatures and mesoscale features will be obtained for several intensive case study periods during the winter of 1978-79 in the Sierra Nevada as part of the Sierra Cooperative Pilot Project. These analyses will use digital imagery collected from the GOES-West satellite by the Colorado State University direct readout ground station. Ditital radar, rawinsonde, cloud physics instrumented aircraft, snowgage, and dual-Doppler data will supplement the analyses of satellite imagery to determine the three-dimensional structure and major precipitation producing characteristics of the orographic systems affecting the Sierra Nevada. Analysis of cloud top temperature will be used to define the temporal and spatial extent of the seeding temperature 'window.' Mesoscale features observed in the satellite imagery will be related to the location, time, and intensity of precipitation in the SCPP. These two analyses of digital satellite imagery will: (1) improve our understanding of winter orographic systems, (2) enable us to develop better methods to enhance precipitation from these systems and (3) improve the statistical design of these experiments to filter out the large mesoscale natural variability.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0011, HYDROLOGY OF ESTUARINE INTERTIDAL ENVIRONMENTS
J.L. Glenn, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Bldg. 53 Denver Federal Ctr., Mail Stop 415 Box 25046, Lakewood, Colorado* 80225 (CR 74-097)

Estuaries are subject to natural and artificial stresses that combine to threaten their continued utility to man. Many estuaries are filling with sediments from external (rivers and the ocean) and internal (shore erosion and biological production) sources. As a result, navigation often is difficult or impeded, maintenance of navigational channels is costly and continually necessary, and the value of recreational and commercial fisheries is diminishing. Estuarine intertidal and supratidal environments are particularly subject to man-induced stresses which directly alter valuable nursery and feeding grounds for many desirable forms of estuarine life.

(1) To establish and to evaluate qualitatively and quantitatively the sources of sediments in estuaries, with initial emphasis on the intraestuarine (intertidal and supratidal) source(s); (2) to characterize the nature and composition of sediments in, from, and beneath intraestuarine sources as an aid to understanding erosional, transportational, and depositional phenomena; (3) to document changes in intraestuarine sources as a result of man-induced stresses and to relate the changes to causative factors; (4) to provide data for making more intelligent predictions of the effects of nature and man in estuaries.

Aerial photographs and hydrographic and topographic data will be combined with field observations and samples in a reconnaissance survey of sedimentologic, geomorphic, and biologic attributes of intraestuarine sources. The stratigraphy of source areas will be investigated to aid in reconstructing the course of events that produced the present environments and in predicting the future course of events. Detailed field studies of modern sediment erosion, transport, and deposition in selected source areas will follow the stratigraphic phase and will be accompanied by laboratory determinations of the nature and composition of surface, subsurface, and suspended sediments. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0012, SERVICES OF POLAR STAR AND GLACIER, ANTARCTIC SEASON 1978-79
R.H. Overton, U.S. Dept. of Transportation, U.S. Coast Guard, *400 7th St. S.W., Washington, District of Columbia* 20590 (DPP77-01365 A02)

Annually, the U.S. Coast Guard has deployed icebreakers to Antarctica to break a ship channel (about 20 miles) through the ice into McMurdo Station. Once the channel is broken and cleared of floating ice, the supply tanker and the stores ship can enter McMurdo Sound and off-load the fuel and other logistics support materials for the annual resupply of Pole Station, Siple Station, and McMurdo Station. Normally, this is a two icebreaker operation in case one of the icebreakers becomes beset in the ice.

While the supply ships are transiting the ice channel, they are escorted or tended by one icebreaker in case the channel refills with floating ice. The second icebreaker is free to support science projects which can be in the Ross Sea and/or the Weddell Sea. These projects are sometimes in the open ocean but more frequently take place at the edge of, or inside, the heavy ice pack.

The Foundation pays a user charge for the icebreaker services.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0013, FIELD MEASUREMENTS OF MESOSCALE WEATHER SYSTEMS
J.J. Stephens, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Meteorology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (ATM7827420)

The primary goal of this research is to develop comprehensive data sets that serve to (1) verify numerical mesoscale models and provide real data model initialization and (2) yield statistics suitable for the experimental design of a complete mesoscale experiment. During the first year support is provided for the analysis of previous data and for the collection and reduction of data from two Doppler radars, an automated mesoscale surface meteorological network, and two meteorologically instrumented aircraft which are participating in SESAME (Severe Environmental Storms and Mesoscale Experiment) in Oklahoma during the spring of 1979. Additional radar, surface, rawinsonde and aircraft data will be available from other SESAME participants and will be included in the subsequent comprehensive data sets and their analysis. In addition to providing unique data sets for numerical modeling studies the observational program will provide data to develop improved experimental designs for future mesoscale experiments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0014, EVALUATION OF REMOTE-DATA ACQUISITION SYSTEMS IN WEST-CENTRAL FLORIDA
W.M. Woodham, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tampa, Florida* (FL 76-263)

Increasing number of developments on water-front property that is subject to frequent and severe flooding and demands being placed on available water resources in west-central Florida require current hydrologic information on existing ground and surface water conditions in the Southwest Florida Water Management District. Current hydrologic data must be available for water managers to protect local and regional water resources. Current data needs include water levels of key lakes and over developed well field areas, and monitoring extreme flow conditions.

Objectives include acquisition, testing, and evaluation of a telemeter system composed of satellite and land-line telemeters. Results obtained in this evaluation will be used as bases for developing a large-scale telemeter system for the Southwest Florida Water Management District.

Battery powered digital telemeters will be obtained and operated at key data stations. Six telemeters will be operated via

GOES Satellite, two by LANDSAT Satellite, and one by telephone line. Telemetry data will be processed on the Survey computer system and a locally owned minicomputer. Operational characteristics of the system will be evaluated and a brief report prepared.

Network stations installed and operated during year include 5 additional GOES Satellite Convertible Data Collection Platforms (CDCP). A total of 6 CDCPs, 2 LANDSAT, and 1 land line telemeter were operational by end of FY78. Telemetry data are continuing to be evaluated and report is in review process.

Continue evaluation of data from present network and prepare a final report.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0015, EXPERIMENTAL SATELLITE DATA COMMUNICATIONS BETWEEN SHIPS AND SHORE

O.B. Brown, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, Dept. of Meteorology & Physical Oceanography, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (OCE78-07802 A01)

This award will provide the support for the second year of an experimental ship-to-shore message and data handling communications system. The program is testing the feasibility and utility of real-time data and voice communication via the ATS satellite in the conduct of oceanographic research and operations. A principal function of the grant will be to provide support for the University of Miami to act as liaison between NASA and the academic fleet to facilitate and coordinate use of the ATS system.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0016, SEA-AIR EXCHANGE (SEAREX) - PHYSICAL ASPECTS OF SEA-AIR EXCHANGE BUBBLES AND SPRAY

E.B. Kraus, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, Dept. of Atmospheric Sciences, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (OCE79-14616)

The SEAREX project is a multidisciplinary study of materials transport across the air-sea interface. Investigators will test the hypothesis that a major fraction of pollutants introduced to the ocean and atmosphere is removed by particle scavenging. Sampling stations at Enewetok in the North Pacific and American Samoa in the South Pacific provide equatorial coverage of a major ocean away from human activities. Aerosol compositions will be measured at these stations, and estimates will be made of net transport to the ocean during times covering both wet and dry seasons. Results from these studies will provide the first measures of fluxes of substances representative of the uncontaminated marine atmosphere. Sources of these substances will be determined and processes controlling their exchange across the air-sea interface will be studied.

The SEAREX project is conducted by investigators from ten research institutions as follows: University of Rhode Island, California Institute of Technology, Centre National de la Recherche Scientifique, Yale University, Woods Hole Oceanographic Institution, Texas A & M University, University of Miami, University of Connecticut, University of Illinois and the University of East Anglia. Coordination with GAMETAG (Global Atmospheric Measuring Experiments on Tropospheric Aerosols and Gases) will continue.

This award supports studies of bubbles and spray in various sea states and their role in the production of sea salt aerosols. Measurements will be made of number density, size, residence time, displacement from the surface and changes in the near-surface aerosols. Additional meteorological support will be provided by this award using information from weather satellites.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0017, NAVY ENVIRONMENT - SEDIMENT DYNAMICS OF A MACROTIDAL COASTAL EMBAYMENT

D. Nummedal, Louisiana State University, Agricultural & Mechanical College, School of Arts & Sciences, Dept. of Geology, *University Station, Baton Rouge, Louisiana* 70803 (DN875690; N00014-78-C-0612)

The objective of this task is to delineate, and subsequently model, the dynamic behavior of intertidal and subtidal sand bodies in a high-tide coastal environment of low offshore lope gradient. Such environments comprise an important class of coastal environments as a whole and include several strategic regions in which Navy and Marine Corps forces could be called upon to undertake operations.

Field research will concentrate on the short-term (hours to days) variability of sand features with lesser emphasis on the long-term (months to years) variations. Sand structure will be mapped on an hourly/daily basis using beach survey tools, fathometer, and aerial photography. Extensive hydrographic measurement of select areas will be made during spring, mean, and neap phases of the tide. Direct determinations of sand transport will be made with dye tracers and bedform trenching. Tide and meteorological data will be acquired from coastal observation stations of the local government. The field site chosen for this work is the German Bight between Ringkobing, Denmark, and Den Helder, Netherlands.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0018, SEASAT PROGRAM - 'SEASAT-A ALTIMETER OVERLAND TRACKING ANALYSIS'

R.L. Brooks, E G & G Inc., Wolf Research & Development Group, *2150 Fields Rd., Rockville, Maryland* 20850 (K7-933; MO-A01-78-4333)

OBJECTIVE: To evaluate SEASAT-A satellite radar altimetry as a tool to accurately and rapidly profile terrain features.

APPROACH: The resultant satellite altimeter-derived profiles will be compared with existing topographic maps and recent leveling surveys to determine the agreement or disagreement. In addition, terrain profiles from repeating ground traces of the satellite altimeter will be inter-compared to assess the repeatability and internal consistency of the altimeter data. The altimeter's performance will be evaluated over as many differing terrain types as possible.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0019, HYDROLOGIC-OCEANOGRAPHIC INTERRELATIONS

F.A. Kohout, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Woods Hole, Massachusetts* 02543 (NR 66-042)

Geophysical and drilling programs are being developed to evaluate the potential value of energy resources on the outer continental shelf (OCS) for lease sales and to appraise the environmental impact of development. At the inner margin of the OCS lies the arbitrarily defined coastal zone which includes strand line, estuaries, bays, rivers and contiguous land areas adjacent to the coast. At present one-half of the U.S. population lives in the coastal zone and 80% is projected for the year 2000. Thus, the need for an interdisciplinary study is obvious.

The position of the transition zone between fresh and salt water in coastal aquifers is an important initial boundary condition required for predictive mathematical modeling of salt-water intrusion. A technical objective is to investigate water circulations between the ocean, estuaries and bays and the underlying permeable strata and observe the various phenomena of groundwater discharge such as submarine springs. A second objective is to provide liaison with the Geologic Division, USGS, in OCS investigations. Identification of the seaward extension of aquifers and geologic formations in OCS drill holes will aid (1) in evaluating the energy and mineral resources of the OCS, (2) in appraising the impact of OCS resource development on environmental values of the coastal zone, (3) in fixing the position of the fresh-salt transition zone in ground water for predictive mathematical model studies of salt-water intrusion.

Investigation of water, energy, and mineral resources is accomplished by correlating chemical, thermal, turbidity, and remote sensing observations of surface and ground waters with geologic and bathymetric features of the OCS and coastal zone determined by geophysical surveys and exploratory drilling. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0020, USE OF AUTOMATED PROCEDURES FOR CHANGE DETECTION AND LAND USE MAPPING FROM SATELLITE DATA

H.W. West, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0W8184)

To develop and demonstrate automated procedures for obtaining land-use classifications from satellite data that are acceptable for use by the Corps divisions and districts in detecting land use changes and producing land-use maps.

Computer procedures will be developed that will automatically and/or interactively (a) locate and extract spectral data from satellite magnetic data tapes for specified geographic regions and sort the data into unique signatures on the basis of radiance values recorded for each pixel for four spectral bands, (b) remove instrument noise and correct radiance values for the effects of terrain slopes, shadows, and atmospheric conditions, (c) rectify positions of satellite pixel elements to the UTM coordinate system of topographic base maps, (d) classify the sorted radiance values on the basis of spectral signatures for five land-use types (water, woods, open or cultivated fields, urban, and other) and verify at a specific location, and (e) compare radiance values from two satellite fly-overs and portray changes in land use on a map overlay. The accuracy of land-use mapping by these procedures will be demonstrated for Baton Rouge, LA, and vicinity. If time permits these procedures will be applied to other areas.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

5.0021, FIELD OBSERVATIONS OF ICE JAMS

G. Frankenstein, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (31355)

OBJECTIVE: To collect field data necessary to undertake other basic ice jam studies, to provide a better insight into shore erosion affected by ice, and to provide a comprehensive background of the nature and range of relevant parameters associated with the wide variety of ice jam types experienced in nature. To aid and advise Corps Districts and Divisions during emergency ice conditions.

APPROACH: An active program of visits to ice jam and erosion sites will be undertaken, primarily at the time of ice cover, but also supplemented by field visits to the specific sites both before and after the ice cover. Qualitative and quantitative information will be obtained at each site on the general ice jam structure or morphology, its dimensional ice characteristics such as thicknesses, shapes, and size of the constituent blocks; flow data such as depths, velocities, and distribution; channel characteristics in the ice jam vicinity; man-made features such as bridges, dams, or levees which affect ice jam formation; climatic parameters affecting ice jam development and deterioration; techniques used, if any, to alleviate the ice jam, and their degrees of success. The geographical scope of the effort will be nationwide, except that the erosion work will concentrate on the St. Marys River.

Many ice jams resulting from the late January 1976 thaw were observed in the New England, New York and Baltimore Districts of Corps of Engineers. Two jams in the Chicago District were also observed. Aerial photographic coverage of the local jams on the Ammonoosuc, Waits, White Pemigewassett, Ottauquechee and Connecticut Rivers was obtained. Field surveys on the Ottauquechee were continued. A contract with Dr. George Alger was made to study erosion and near shore sediment movement during winter conditions on the St. Marys River. On-site consulation on ice jam and related winter navigation problems was given to New England Division, New York, Buffalo, Pittsburg; Huntington, Louisville, St. Louis and St. Paul District of the Corps. The use of a Hovercraft to break-up the Mississippi jam did not take place.

A draft Ice Engineering Manual was completed and used during presentation of a course to C of E personnel.

For the erosion studies, the observation program on the St. Marys River will be continued on a less intensive but broader scope. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

5.0022, VERTICAL DEFORMATION STUDIES IN THE ALEUTIAN SHUMAGIN ISLANDS SEISMIC GAP

R.G. Bilham, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (14-08-0001-17679)

STATE TO WHICH PROJECT PERTAINS: Alaska.

We plan to install a network of seven devices to monitor mean sea level to a precision of 1mm in the Shumagin Islands of Alaska. These islands extend more than 100 km toward the deep sea trench in a part of the Aleutian seismic zone that we believe will soon experience a major earthquake (Mb is greater than 7). If we can obtain differences in sea level for monthly periods with accuracies better than 1 cm we believe that we will be in a strong position to monitor precursory seismic deformation. In the first year of this project we plan to obtain estimates of sea level noise resulting from atmospheric disturbances. The network will be telemetered via satellite. The aims of the experiment are to investigate whether sea level can provide a precursory warning of earthquake imminence, and to study earthquake mechanism should one occur during the duration of the project.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0023, SEASAT PROGRAM - GEODETIC STUDIES WITH SEASAT-A

M. Talwani, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (7-927; MO-AO1-78-00-4324)

OBJECTIVE: To examine altimeter data in the 100-200 km wavelength range for studying geoid anomalies related to specific geological and tectonic features, and finally to map oceanographic anomalies.

APPROACH: Gravimetric geoids will be constructed in the western North Atlantic and in the western Pacific for comparison with SEASAT-A data. These data are based on all available gravity data which have been carefully checked and are expected to yield the most accurate gravimetric geoids in those areas. Comparison between altimeter-determined sea surface heights and the gravimetric geoid will be used in estimating the sea surface topography attributed respectively to oceanographic phenomena and to gravity variations. The time varying part of sea surface topography may also be determined. The association of the geoid with several morphological and tectonic features of the world's oceans will then be established and refined; attempts will also be made to interpret the geoid undulation in geological and geophysical terms.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0024, EQUILIBRIUM AND FRACTIONAL CRYSTALLIZATION OF LUNAR MAGMAS - COTECTIC AND SULPHUR SOLUBILITIES

M.J. Rutherford, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (EAR79-08511)

This is a continuing study which had previously been supported by NASA but transferred to the NSF for support. Work to be done this year consists of (1) High pressure experiments on ilmenite and Ca-pyroxene saturation in 15382 and a LKFM derivative to further investigate possible high Ti mare source cumulates. (2) High pressure experiments on different LKFM basalts to determine Ca-pyroxene saturation and further evaluate proposed lunar magma compositions. (3) Continued experimen-

tal work on sulphur solubility in mare and non-mare basalts at low and high pressure. (4) Experiments to determine the liquid-solid equilibria of such phases as apatite, whitlockite and Ba-rich feldspar in highly evolved lunar magmas.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0025, RESERVOIR QUALITY CLASSIFICATION
J.M. Higgins, U.S. Tennessee Valley Authority, *401 Chestnut St., Room 268 - 248 401 Bldg., Chattanooga, Tennessee* 37401

The objectves of this work are to quantify the general quality (trophic status) of TVA reservoir; to compare the quality of each with desirable levels; to establish acceptable nutrient and waste loading levels; and to develop models for using LANDSAT imagery to economically monitor spatial and seasonal quality variations. During 1978 nutrient (N and P) loading rates were determined for the 18 largest TVA reservoirs. During 1979 field data were collected at these reservoirs to quantify quality and provide ground truth data for satellite monitoring. Current work includes model development and comparative studies based on the 1978-79 work.

SUPPORTED BY U.S. Tennessee Valley Authority

5.0026, OPERATIONAL REMOTE SENSING TECHNIQUES FOR TRANSPORTATION MAPPING
Hansen, University of Tennessee, Central Office, Space Inst., *Tullahoma, Tennessee* 37388 (193063 (HRB NO.))

Develop training course on remote sensing and interpretation methods of aerial photography.

SUPPORTED BY U.S. Dept. of Transportation, Office of Development, Implementation Div.

5.0027, OPERATIONAL REMOTE SENSING TECHNIQUES FOR TRANSPORTATION MAPPING
Hansen, University of Tennessee, Central Office, Space Inst., *Tullahoma, Tennessee* 37388 (FH-11-9270; FH162204 (TRAIS NO.))

The contractor shall develop training course on remote sensing and interpretation methods of aerial photography.

SUPPORTED BY U.S. Dept. of Transportation, Federal Highway Admin.

5.0028, EXPERIMENTAL INVESTIGATIONS INTO THE COOLING HISTORIES OF LUNAR ROCKS
L.A. Taylor, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Geological Sciences, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (EAR79-06318)

This study is a continuation of investigations previously funded by NASA and now transferred to NSF for support. This work involves determination of various kinetic data important to interpretations of crystallization under near-surface conditions (i.e., hypabyssal-extrusive). Studies of opaque minerals and the development of a new technique for paleointensity measurements will also be carried out. Specific tasks to be undertaken by this study involve: (1) investigation of the effects of cooling rate on: a) pyroxene chemistry, b) armalcolite-ilmenite relations, c) plagioclase nucleation and growth, and d) olivine vitrophyre fractional crystallization; (2) study of the kinetics of diffusive reequilibration for use in models on minerals as cooling speedometers: a) olivine and b) mineral pairs; (3) characterization of native FeNi metal from certain Apollo 12 soils in coordination with siderophile chemistry of the soils; (4) perfection of a technique for the measurement of paleointensities of lunar rocks at elevated temperatures while keeping the sample in pristine condition.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0029, OBSERVATIONS OF TOPOGRAPHIC ROSSBY WAVES AND GULF STREAM MEANDERS ALONG THE CONTINENTAL SLOPE
D.A. Brooks, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Oceanography, *College Station, Texas* 77843 (OCE79-06710)

This project, which involves field observations and data analysis, is designed to study topographic and meteorological forcing of observed meanders of the Gulf Stream along the continental slope south of Cape Hatteras, North Carolina. A field study consisting of four-month long winter and summer mooring periods will examine the detailed structure and time history of the current and temperature fluctuations along the continental slope off North Carolina. Vertical and cross-slope structure and along-shore propagational characteristics will be determined. Correlation of the current and temperature data with wind data, and comparison of direct current data with satellite imagery of sea-surface temperature patterns will be done to investigate the possibilities of wind or lee-wave forcing. Field data will be compared with theory to assess the importance of stable topographic Rossby wave propagation and instability processes in the Stream. This is a three year project with the field work occurring during the first and second years. The first year of the study was supported by NSF Grant Number ICE77-25682 to North Carolina State University at Raleigh.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0030, WATER QUALITY LABORATORY FOR CHESAPEAKE BAY AND ITS TRIBUTARIES AT HAMPTON INSTITUTE
Unknown, Hampton Inst., Graduate School, *Hampton, Virginia* 23368 (R806229; Q771 -Q145)

OBJECTIVE: This study will evaluate a helicopter sampling system for applicability to wide area Bay Sampling scheduled to coincide with TELSAT pass-over for water truth comparision with the Satellite data. The study will also determine the economics of helicopter sampling versus boat sampling.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Gulf Breeze Environmental Research Lab.

5.0031, NAVY ENVIRONMENT - GEOPHYSICAL DATA ANALYSIS
S.A. Vincent, Phoenix Corp., *1600 Anderson Rd., McLean, Virginia* 22102 (DN975375; N00014-79-C-0409)

Satellite altimetry and aeromagnetic data will be analysed for studies of ocean gravity anomalies, ocean tides, and geomagnetic field fluctuations.

GEOS-3 Satellite altimetry data will be analyzed for ocean tidal components in the northeast Pacific. A detailed background review will be conducted on the relevant physical aspects of the various sources of temporal geomagnetic field variations and their quantitative indicators.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0032, GEOLOGICAL THERMOMETRY - NASA
J.S. Huebner, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9710-01155)

Determine the physical properties and phase relations of pyroxenes, using a combination of optical and electron microprobe analyses, X-ray and electron diffraction, and experimental petrology. Apply the results to problems in lunar petrogenesis such as basaltic magma genesis; extent and conditions of metamorphic equilibration; and the dating of events which caused mineral transformations. The major topics of investigation will be: 1) Interpret the thermal and structural histories of pyroxenes, estimating the lengths of time that each structural state was annealed at temperatures that we will determine from our data on pyroxene phase relations. We are interested in all processes from the nucleation of pyroxene in basalts at high tempera-

ture to the low-temperature annealing that imposes the texturally mature fabric, the extensive chemical reequilibration, and the high degree of cation order in 'Apollonian' metamorphic rocks. 2) Determine, experimentally and from analysis of lunar samples, the volume diffusion rates of calcium, magnesium and iron in pyroxenes in order to calculate the lengths of time necessary to grow pyroxene lamellae during lunar annealing processes. 3) Complete an experimental investigation of the partial melting of pyroxenes (orthopyroxene, pigeonite, augite) and model lunar mantle peridotite and pyroxenite. Continue to refine our models for the derivation of lunar basaltic magmas, and characterize the solid residues of such processes. 4) Complete a study of the occurrence, crystal chemistry, and significance of protoenstatite. 5) By providing samples and mineralogical expertise, participate in cooperative investigations of the calorimetric properties, electrical conductivity, and radiative heat transfer of pyroxenes.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0033, LOCATING GROUND-WATER SUPPLIES BY REMOTE SENSING - RANDOLPH COUNTY, WEST VIRGINIA

W.A. Hobbs, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Morgantown, West Virginia* (WV 78-034)

Determine where supplies of ground water of adequate quantity and quality can be developed to augment existing surface water supplies for growing communities.

(1) Map lineaments and faults from satellite and aircraft imagery; (2) inventory, sample, and perform single-well aquifer tests on selected domestic wells; (3) drill 3 test wells in one area where well yield and water quality are likely to be best; (4) perform aquifer tests on the test wells to determine aquifer characteristics and sample water for complete chemical analysis; and (5) prepare a concise report describing techniques, findings, and interpretations.

The area to be investigated is a valley about 15 miles long and 4 miles wide between Elkins and Mill Creek, WV. The approach will be to first map the lineaments in the valley by video analog enhancement of satellite and aircraft imagery. After the lineaments are mapped, domestic wells on or near elected lineaments will be inventoried, sampled, and pumped. Based on this information, and the needs of the county, three test wells will be installed and aquifer tests performed to evaluate the aquifer.

Satellite imagery of area and all field reconnaissance completed. Drilled test wells.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0034, WATER AND ITS RELATION TO ECONOMIC DEVELOPMENT IN THE GREEN RIVER AND GREAT DIVIDE BASINS IN WYOMING

H.W. Lowham, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Cheyenne, Wyoming* (WY 75-030)

Development of extensive coal, oil, gas, trona, and oil-shale resources in the project area will require a projected increase in water consumption of 480,000 acre-feet per year by 1990. Development of energy resources in other parts of the state also will require large amounts of water; transbasin diversion of Green River water to other areas could total an additional 270,000 acre-feet per year. Water planners and managers need much more information about available ground and surface water, present quality of the waters, and the impacts on water supply and quality caused by development of energy resources.

The study will be designed to gather information, and make available to interested industrial, agricultural, and governmental people, interpretive reports that describe: (1) the distribution and quality of surface water in space and time, (2) relationships between surface water and ground water, (3) the distribution, quantity, and quality of ground water, and (4) hydrology-related aspects of the environment. Efforts of the study will be directed towards: (1) describing the water resources and hydrologic relationships that presently exist, (2) developing predictive methods that may be used to describe future conditions, including reactions to increased water development, (3) establishing monitoring programs for detecting possible changes in water parameters.

Compile and evaluate existing water data. Conduct literature search for present hydrologic knowledge of the area. Prepare planning report during first year of project, outlining the specific techniques to be used in subsequent phases. Regarding water quality, particular attention will be given to trace metals, biological parameters, and trend analysis. Channel-geometry techniques, ERTS imagery, and detailed statistical analyses will be applied to surface-water studies. Aquifer tests and bore hole and surface geophysical surveys will be used in ground-water studies. Digital models will be developed for chemical-quality and surface-water systems.

An intensive sampling program was conducted during the Fall and the Spring, using a helicopter and 8 hydrologists. Water-quality samples and field measurements were collected at several hundred surface- and ground-water sites. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, RESEARCH OF BIOENGINEERING PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION (07)

J.L. Haley, U.S. Dept. of Defense, Army, Medical Research & Development Command, Bioengineering & Life Support Equipment Div., *Fort Rucker, Ozark, Alabama* 36362 (DA0D6735)

To provide valid, meaningful and medically pertinent information, new designs and equipment developments based on research with respect to immediate field aeromedical problem areas found in US Army aviation.

Approach will always be based on sound and accepted experimental methodology, though particular techniques of application will vary as a function of the problem under investigation.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, DEVELOPMENT AND EVALUATION OF ADVANCED INSTRUCTIONAL FEATURES METHODS IN ASPT

R. Hughes, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224020)

1. To develop through active experimental manipulation effective applications of ASPT advanced instructional features to air-to-surface training. 2. To identify factors affecting the effective management of ASPT advanced instructional features within the context of A-10 air-to-surface training. 3. To develop and evaluate candidate measures of instructional effectiveness.

Two phases are proposed. Phase I is a developmental phase in which a series of mini-studies will be conducted to identify promising applications of ASPT instructional features in the training of air-to-surface attack skills on the A-10. The emphasis in phase II represents a shift in focus from the student to the instructor and the manner in which the instructor is able to utilize the instructional features as an aid to training. A chief concern in phase II will be upon the instructor's allocation of instructional time and practice time and the effects of such allocation upon student performance. Measures of effectiveness such as performance gain per unit of instructional time will be evaluated for their sensitivity to different strategies of employing advanced instructional features.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, SUBJECTIVE PERFORMANCE MEASUREMENT

E.L. Martin, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223710)

1. To develop a pilot performance measurement system and methodology for airborne application. 2. To develop an efficient and effective observer training program.

A series of at least three studies will be conducted in order to accomplish objectives. Candidate task measurement formats for selected tasks will be developed analytically. The prerecorded demonstration capability of the ASPT will be used to provide controlled measurement observation set for data collection. IPs will serve as subjects. Task formats, observation intervals, and training procedures will be selected so as to optimize reliability and validity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, INVESTIGATION OF BRAINSTEM AUDITORY EVOKED RESPONSES AS A NEW MEASURE OF SENSORINEURAL PERFORMANCE OF NAVAL AVIATION PERSONNEL

J.D. Mosko, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., *Pensacola, Florida* 32512 (DN877423)

Recent research and clinical applications of brainstem auditory evoked response technology indicate that this measure may provide a sensitive means for the early detection of sensorineural changes that occur (1) as a function of aging, both natural and premature, and (2) as a result of exposure to environmental stressors. It will be the objective of this work unit to conduct exploratory research that will evaluate the potential contributions of brainstem technology to the medical management of naval aviation personnel.

Before brainstem technology can find application in the evaluation of naval aviation personnel, baseline data must be collected which define the normative range of responses for this broad age-spectrum population. Although all forms of electrophysiological measures require normative references to be effective, the need is specific for brainstem responses in that the latency of the predominant waveforms is strikingly age dependent. Since this feature in itself may serve to quantify sensorineural aging of naval personnel, first priority will be given to the acquisition of brainstem data from naval aviation personnel stationed at Pensacola ranging in age from 20 years to 50 years. This population will be subdivided into six equal increment age categories with a minimum of 30 individuals in each category. The collection of these baseline data is considered to be an essential cornerstone to follow-up research that will deal with modifications of the brainstem response by various environmental stressors.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0005, DEVELOPMENT OF PSYCHO-PHYSIOLOGICAL MEASURES PREDICTIVE OF AVIATION PERFORMANCE

R.E. Doll, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Aerospace Psychology Dept., *Pensacola, Florida* 32512 (DN977562)

OBJECTIVE: The objective of this work unit is the measurement and evaluation of psycho-physiological human ability measures that have the potential to significantly predict aviator performance in replacement training squadrons (RTS) and fleet squadrons. Due to the great length of time required to determine the relationship to psycho-physiological human ability measures to aviator performance in RTS and fleet operational environments, preliminary investigations will be concerned with human performance in an undergraduate flying environment. Early criteria to be used to evaluate the utility of psycho-physiological human ability measures will include (1) primary flight performance, (2) intermediate flight performance (strike, maritime and helo), (3) advance flight performance (strike, maritime, and helo), and successful undergraduate performance. Ultimately, RTS and fleet squadron standardized summary performance grades and certain fleet performance indices will be related to the psycho-physiological human ability measures. Since the present BUMED United States Navy and Marine Corps aviation selection tests are primarily perceptual and cognitive pencil-and-paper test instruments, it is anticipated that the development of psycho-physiological human ability measurement instruments will provide for an improved capability to select aviators who will have a greater flying fitness capability in operation environments. Additionally, the psycho-physiological measures have the potential for improved primary, secondary selection, and pipeline assignment, thereby affecting important naval aviation cost savings. In addition, it is anticipated that performance measurements will be accumulated for psycho-physiological measures on the basis of age. With time, such measurements may be used to evaluate skill maintenance levels, and provide a basis other than age for assigning service group flying categories.

The research effort will obtain psycho-physiological human ability measures on a substantial Navy population. The first psycho-physiological measure to be investigated is: multilimb coordination ability: the ability to quickly and accurately perform coordination movement of body muscle systems as a result of the perceptual and kinesthetic recognition of velocity and speed movements in a dynamic three-dimensional environment, is a highly important psycho-physiological attribute. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0006, PREVENTION OF MOTION SICKNESS IN FLIGHT TRAINING BY TRANSFER OF ADAPTATION EFFECTS ACQUIRED IN THE LABORATORY

A. Graybiel, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Biological Sciences Dept., *Pensacola, Florida* 32508 (DN777277)

Restoration to flight status of motion-sick Navy flyers by measures which include transfer of adaptation effects acquired in the laboratory.

The approach will continue to feature (1) an initial interview, (2) a battery of assessments, (3) identification of a long-term antimotion sickness drug, (4) adaptation in the slow rotation room, and (5) validation in actual flight. Additional use will be made of plots that describe the rates of acquisition and decay of adaptation effects, e.g., adaptation under medication levels-off and suggests continuance without medication. Looking ahead, the possible use of a passive head-movement device will be tested both at the center of adaptation and at a radius of 19 feet. Also, additional adaptation effects will be explored using visual inputs (movies projected on a cinematic screen) and an off-vertical chair that selectively stimulates receptor systems in the otolith organs.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0007, THE DEVELOPMENT OF SATELLITE TRACKING AND AUTOMATIC POSITION/ACTIVITY MONITORING FOR SELECTED ANTARCTIC VERTEBRATES

D.B. Siniff, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Ecology & Behavioral Biology, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (DPP79-21713)

The University of Minnesota proposes to begin the development of technology (and its biological application) which will open the way for remote monitoring of movements of free-ranging antarctic vertebrates. Specific objectives include: (1) the development of telemetry packages for tracking the Weddell Seal and the Antarctic Cod; (2) obtain data on the local movements of these species while developing the instrumentation and attachment procedures; (3) develop a data collection system for the McMurdo Sound area which will telemeter data from key position monitoring stations to a central laboratory or to a satellite; and (4) conduct tagging and census studies of the Weddell Seal population in McMurdo Sound. The long term goals are (1) to use the instrumentation developed to begin to understand the movements of vertebrates from one region of Antarctica to another, (2) use the movement, activity, and other data realized to better understand the antarctic ecosystem, and (3) to inte-

grate the data collected with other studies to assist in making management and conservation recommendations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

6.0008, ELECTRORETINOGRAM (ERG) IMPLICIT TIME 16272-L
J.B. Siegfried, Pennsylvania College of Optometry, Graduate School, Dept. of Physiology, *Philadelphia, Pennsylvania* 19141 (DAOG9078; DAAG29-79-C-0103)

To elucidate the region or regions in the human visual system that account for the long time constants of the blue color system. Relevance - related to night vision processes where exposure to white and yellow flashes interfere with red and green systems. Will apply to pilots and aircraft controllers in night operations.

A two color increment threshold para.ligm will be used in addition to electroretinogram (ERG) measures of amplitude and implicit time of test flash luminances close to psychophysical increment thresholds. Foveal test flashes will be superimposed on steady, peripheral adaptation. Computer signal to noise enhancement will be used.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

6.0009, COST-EFFECTIVENESS METHODOLOGY FOR AIRCREW TRAINING DEVICES
B.R. Girshaw, Analytic Services Inc., *400 Army Navy Dr., Arlington, Virginia* 22202 (DF223850; F33615-77-C-0072)

To develop a cost-effectiveness methodology for aircrew training devices that is consistent over a broad range of training situations, flexible in accommodating differences in data inputs and outputs, sufficiently comprehensive to permit inclusion of a variety of significant factors, and simple to use. It will be applicable to the analysis of both existing and future aircrew training systems. It will also contribute to the analysis of many aspects of training effectiveness to include determination of device cost-effectiveness, the optimum mix of several devices, and the optimum deployment and utilization strategies for training devices.

A systems approach will be taken to encompass the total aircrew training program including intital and continuation training. The study will be accomplished in phases. Phase I will serve to familiarize the contractor with AFHRLS flying training research program and allow finalization of research approach. Phase II will provide a workable methodology for evaluating the cost-effectiveness of aircrew training systems employing a mix of training devices. Phase III will require a validation of the proposed methodology using data from a current Air Force weapon system aircrew training program. Phase IV will apply the methodology to a proposed Air Force training system. Phase V will document results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, DEVELOPMENT OF A MATHEMATICAL MODEL TO CORRELATE OBSERVED FROST HEAVE OF HIGHWAY AND AIRPORT PAVEMENTS WITH LABORATORY PREDICTIONS
Berg, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (135563 (HRB NO.))

The aim of this project is to develop a mathematical model of frost heave in terms of the significant physical, environmental and climatic factors, and make a sensitivity analysis of the various parameters. Also, a work plan, including staffing and instrumentation requirements, will be developed to correlate laboratory results with field observations by use of the mathematical model.

SUPPORTED BY U.S. Dept. of Transportation, Office of Research, Materials Div.

7.0002, SOFTWARE SYSTEMS FOR PROCESSING ADVANCED SATELLITE DATA
L.P. Murphy, U.S. Dept. of Defense, Army, Corps of Engineers, Engineer Topographic Lab., *Fort Belvoir, Virginia* 22060 (31580)

OBJECTIVES: Analyze, model, develop techniques, software, and perform feasibility testing of algorithms for extracting useful terrain data from advanced (LANDSAT-D) satellite systems for selected CoE applications; hardware/software trade-offs and costs for computer processing of the advanced high resolution (30 m/pixel) Thematic, Mapper, LANDSAT-D, digital data.

APPROACH: Under contract in FY 79, a study will be performed to develop a preliminary assessment of systems costs, hardware/software trade-offs for processing LANDSAT-D Thematic Mapper (TM) data (8 times that of current systems) for selected Corps remote sensing applications. In FYs 79 and 80, in-house and contracted experiments and studies will be conducted for the development of optimal algorithms and systems for extracting the required CoE terrain/landuse data. LANDSAT-3 RBV data and aircraft or simulated data will be used to simulate the TM. In FY 81, all efforts under this work unit will be consolidated and updated to result in a detailed assessment of costs, hardware/systems trade-offs for the implementation of LANDSAT-D data processing within the Corps; this assessment will include a go or no-go recommendation to Corps headquarters for acquisition or lease of a central data processing facility and/or the use of commercially available systems or services.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Engineer Topographic Lab.

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, TRANSIENT EVAPORATION OF IONIC CRYSTALS
Z. Munir, University of California, Davis Campus, School of Engineering, Dept. of Mechanical Engineering, *Davis, California* 95616 (DMR79-09020)

This grant is to continue fundamental studies on the mechanisms of transient evaporation of ionic semiconductors, such as cadmium sulfide and zinc oxide, particularly as vaporization relates to surface charge. The dependence of the transient behavior on surface charge will be examined in terms of crystallographic orientation, original stoichiometry (or doping) and temperature. Additionally, the effect of extrinsic doping on the transient evaporation rate will be undertaken. Isothermal rates will be measured utilizing torsion and microbalance techniques. Surface ledge spacing and height will be determined in a low energy electron diffraction (LEED) apparatus. These parameters will be examined as a function of the initial ledge spacing, the initial degree of nonstoichiometry, and the degree of undersaturation during evaporation. Relative changes in the point defect concentration accompanying evaporation will be determined from Hall Coefficient and electrical resistivity measurements.

The work is a continuation of research initiated under NSF grant DMR77-08472, and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, HIGH-ENERGY PHYSICS STUDIES
J. Schultz, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (EY-76-S-03-0034 PA 149)

The study concentrates on a search for resonant and bound states in the nucleon-antinucleon system, understanding of production of such states by antiproton interaction in deuterium, and elucidation of mechanisms of pd annihilation. An experiment to be run imminently at Brookhaven National Laboratory (AGS-701) will use an array of counters, multi-wire proportional chambers, and NaI detector to observe outgoing charged pions, recoil nucleons and photons from p annihilations in a deuterium target. Bound or resonant NN states will be observed by recoil nucleon spectroscopy, and radiative or pionic transitions between levels can be detected. The experiment is a collaborative effort with the University of New Mexico and Temple University. In addition, a complementary study of pd interactions is using part of a 240,000 picture exposure of the Argonne National Laboratory 12-foot bubble chamber to investigate pd interactions from 700 MeV/c to rest, yielding photons, neutral mesons, and strange particles. Events with photons and recoil protons will complement the BNL counter experiment search for new states. The strange particle data will be combined with a pd exposure in the BNL 30-inch chamber to provide information on kaon and lambda production up to 900 MeV/c.

Another aspect of the program is the development of high energy detection techniques, in particular, investigation of the acoustic radiation of charged particles and the potential use of acoustic detectors. Other types of new detectors are also being studied in participation in the planning of very large scale high energy neutrino experiments.

SUPPORTED BY U.S. Dept. of Energy, Div. of High Energy & Nuclear Physics

8.0003, PHASE TRANSITIONS AND DISORDER IN SOLIDS BY LIGHT SCATTERING
S. Ushioda, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (DMR77-10083 A02)

Structural phase transitions and disorder in solids will be investigated by means of Raman and Brillouin scattering. The systems to be studied are superionic conductors, organic charge transfer solids and perovskite ferroelectrics. Superionic conductors are translationally disordered and some of the organic charge transfer compounds are orientationally disordered. The study will focus on the liquid-like nature and the phase transitions of these systems. In perovskite ferroelectrics, the main interest will be in the anharmonicity of the soft modes and its relation to the structural phase transitions.

Research previously supported by DMR 73-02480.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, EXPERIMENTAL STUDIES OF QUASI-ONE-DIMENSIONAL CRYSTALS
P.M. Chaikin, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR79-08560)

Certain crystals (such as donor-acceptor complexes involving tetracyanoquinodimethane (TCNQ), and certain layered transition metal dichalcogenides) have electrical properties that are very much different in one direction from the other two. They are of interest because theoretical models for such quasi 1- or 2-dimensional systems are more readily solved than those for 3-dimensional. The small bandwidths, large electron-electron repulsions, and restricted dimensionality make these materials ideal candidates for the study of several questions of basic physical interest. Thus, one-dimensional metals are intrinsically unstable against a metal in insulator transition. The effects of disorder and of impurities also are singular in one dimension, causing severe electron localization.

The present work involves a series of transport measurements (thermoelectric power, thermal conductivity, Hall effect) on several classes of these compounds (including charge transfer salts such as bis(tetrathiatetracene) triiodide and anisotropic metals such as niobium triselenide). The thermopower study is aimed at determining the role played by coulomb correlations and phonon drag; the thermal conductivity and Hall effect studies are aimed at determining the nature of the charge carries involved. Some of these experiments may be performed in high electric fields to study nonlinear transport.

First year of three-year continuing grant; renewal of work supported by DMR76-83421.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, IONS AT THE SURFACE OF LIQUID HELIUM
G.A. Williams, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR78-17049)

An experimental study of two-dimensional ion systems near the surface of liquid helium will be undertaken. A newly developed low frequency capacitance technique will be employed for measurements of ion mobilities. Systems of interest include electrons above the helium surface as well as both positive and negative ions just underneath the surface. Such data will yield information about the nature of the interactions between electrons and the elemental excitations in this unique quantum fluid.

First year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0006, APPARATUS FOR NONLINEAR MIXING SPECTROSCOPY OF CONDENSED MEDIA
M.D. Levenson, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DMR77-27512)

A tunable narrowband C.W. dye laser will be obtained and used in the NSF supported research program to develop and use spectroscopic techniques based upon third-order optical frequency mixing. This additional laser will supplement the capabilities of the present three-frequency coherent Raman spectrometer by providing a tunable optical frequency source devoid of troublesome intensity fluctuations. This quiet source will then permit the use of optical heterodyne techniques to detect signals produced by the Raman induced Kerr effect and by anisotropic saturation in absorbing systems. Resonance and relaxation effects in the nonlinear susceptibility tensor will be studied more conveniently and more precisely.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0007, DYNAMICS OF MOLECULES IN CRYSTALS AND ON SURFACES
N.S. Gillis, Colorado State University, School of Science, Dept. of Physics, *Fort Collins, Colorado* 80523 (DMR76-18738 A01)

Research previously supported by DMR76-18738.

Theoretical research in condensed matter physics will be carried out. The main thrust of the work will be in the areas of the dynamics of motion of molecules in crystals and on surfaces. This will involve an investigation of the rotational excitations of molecules in these environments as well as the coupling of the rotational molecular motions with one another and with other degrees of freedom of these systems, such as phonons. Two specific areas will be studied: (1) Structural phase transitions in molecular solids, particularly the family of the inorganic azides. (2) Rotational motion of substitutional impurities of molecular nitrogen in rare gas matrices.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0008, MEASUREMENTS TO TEST FOR THE VARIABILITY OF THE SOLAR CONSTANT
D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM79-03877)

Professor Murcray (University of Denver) has developed a high precision balloon-borne system for measuring the solar irradiance. With previous NSF support he has shown that the solar irradiance has possibly changed by as much as 0.4% between 1967/68 and 1978. This result is potentially very important to many research areas and, therefore, it is important to check it. This support will enable Dr. Murcray to conduct two balloon flights in 1979 and 1980 for just this reason.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0009, MEASUREMENT OF EMISSION CROSS-SECTIONS OF IMPORTANCE IN THE UPPER ATMOSPHERE

B. VanZyl, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM76-80282 A02)

This grant funds experimental measurements of emission cross-sections of importance in the upper atmosphere. Energy-variable atomic beams of electrons, protons, and hydrogen atoms, will be used to investigate light emissions resulting from their collisions with typical atmospheric atoms and molecules. While the emphasis will be on hydrogen atom and proton scattering, an electron beam is included in the system for absolute calibration of the optical detectors. This provision also allows direct comparison of certain light emissions from target molecule excitations by the three projectile species in the same system under identical conditions. The projectile energy range covered will be from a few keV on down, an important range in the atmosphere, and one for which the existing information is sparse or altogether lacking.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0010, LASER DEVELOPMENT FOR FUSION AND ISOTOPE SEPARATION (ABBREV)

M.S. Lubell, Yale University, Graduate School, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (ES-77-S-02-4199 A000)

The proposed research has as its objective the study of depletion mechanisms of metastable states of rare gas atoms by electron impact. Depopulation of these metastable states significantly affects the operation of rare gas halide lasers, since the formation of the excited state of the rare gas halide excimer, RX*, relies to a great degree upon the kinetic process R* plus X2 yields RX* plus X, where R is a rare gas atom and X is a halogen atom. If the depopulation of the metastables proceeds via a one or multiple step ionization process, then the stability of the discharge which produces the metastables can be destroyed.

While the RX* formation kinetics and the X2 electron attachment process have both undergone considerable study, there has been little experimental attention devoted to the electron impact phenomena involving the excited states of the rare gas atoms. It is already known that cross-sections for excitation of the metastable rare gas s-valence electron to the next higher lying p orbital are large (greater than or equal to 10 to the minus 14th power sq.cm). Thus multiple step ionization process may play a significant role.

The proposed research program employs a triple crossed beams configuration with a metastable rare gas beam incident along one axis, an electron beam along a second axis, and a tunable laser radiation along a third axis. The use of a duoplasmatron ion source and an alkali resonant charge transfer cell is expected to produce an atom beam that has greater than or equal to 30% metastable content with a metastable density greater than or equal to 10 the the 9th power/cu.cm. A spherical electron monochromator/spectrometer will be used to study elastic, inelastic, and superelastic scattering as well as impact ionization from both metastable and laser excited states. Incident electron energies will range from 1 to 100 eV.

Construction and testing in progress.

SUPPORTED BY U.S. Dept. of Energy, Div. of Laser Fusion

8.0011, A STUDY OF THE ROLE OF TIME-DEPENDENT PHENOMENA IN DETERMINING SUPERCONDUCTING DEVICE CHARACTERISTICS

R.A. Peters, Catholic University of America, School of Arts & Sciences, Dept. of Physics, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (ENG76-11553 A02)

This program is concerned with establishing the way in which the superconducting phase slip and electron-phonon collision times determine: (a) the upper frequency limit for SQUID (Superconducting Quantum Interference Device) operation; (b) the relation between bridge separation and frequency limits of arrays of Josephson junctions; (c) the length of a weak link and the frequency dependence of its hysteretic effects; (d) the time necessary to nucleate a normal region in a superconductor. The program will test extensions of the quasiparticle diffusion theory into the rf region. For a given material, this work will predict maximum bridge separation of arrays as a function of frequency, the length of the weak link as a function of frequency for non-hysteretic behavior in SQUIDS, and maximum pump frequency for SQUIDS.

SUPPORTED BY U.S. National Science Foundation, Div. of
Engineering

8.0012, PLASMA ETCHING

R. Kaplan, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980203)

To obtain a basic knowledge of the chemistry and physics of plasma etching of Si and compound semiconductors, with particular emphasis on those aspects relating to fabrication of small, accurately dimensioned structures required for large scale integrated circuits. To investigate the possibility of achieving orientation-dependent plasma etching, with application to the tailoring of etched-wall profiles.

Plasma etching will be conducted in a system compatible with ultra-high vacuum instrumentation (auger spectroscopy, low energy electron diffraction, quadrupole mass analyzer) in order to obtain structural and chemical information regarding substrate surfaces during processing. Simple devices will be fabricated in order to evaluate etched surface electronic properties. Chemical species involved in etching will be studied by detecting their emitted optical radiation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval
Research Lab.

8.0013, NUCLEAR REACTIONS AND STRUCTURE

R.H. Davis, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Physics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (PHY78-11560 A01)

This is a continuation of work presently supported under NSF grant PHY77-08145.

A wide variety of work is proposed in both basic and applied physics. Work will include studies of elastic and inelastic scattering of heavy ions, heavy-ion fusion, reaction mechanisms and heavy-ion resonance phenomena. Some light ion work on back angle resonances and spectroscopy will also be done. Characterization of high spin states also will be studied. Particle-gamma coincidence methods will be used.

Applied work includes the identification of air pollutants, use of electron beams in electrostatic precipitators, and construction of a proton microprobe.

Considerable work on accelerator modification and instrument development will continue.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0014, REACTIONS AND TRANSPORT PROPERTIES OF ATMOSPHERIC IONS
E.W. McDaniel, Georgia Inst. of Technology, School of Sciences & Liberal Studies, Dept. of Physics, *Atlanta, Georgia* 30332 (ATM79-06109)

A high-pressure-drift-tube-mass spectrometer will be used to obtain measurements of the transport properties of ion-gas combinations of atmospheric interest such as NO3, O2, NO2, and CO3 in N2 and NO3, NO, and O2 in O2 over a temperature range of 190 degrees-650 degrees K. Mobility values will also be obtained as a function of E/N (electric field intensity divided by drift gas number density). The results will yield accurate, well-defined transport properties which can be used in calculating ion-ion recombination rates; in modeling atmospheric ion transport and the resulting ion concentrations at high altitudes; and in providing a testing ground for ion transport properties, reaction rate schemes, and calculated atmospheric ion concentrations derived from lower pressure measurements.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0015, A LOW-TEMPERATURE INVESTIGATION OF AMORPHOUS MATERIALS
A.C. Anderson, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR77-08599 A02)

This research was previously supported by DMR 75-09566.

The purpose of this research is to provide a consistent picture of the low-temperature thermal behavior of amorphous materials (glasses, plastics and glassy metals). The work will be directed toward the manipulation and identification of the localized excitations which are generally attributed to the reorientation of small groups of atoms through the mechanism of quantum mechanical tunneling. In particular, the energy dependence and densities of excitations will be studied by the use of ballistic phonon techniques and by noting the concomitant changes in specific heat, thermal conductivity, thermal expansion and other properties. Glassy metals will also be studied to determine the influence of localized excitation on the electronic properties of amorphous materials and to test current ideas of glass formation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, ATOMIC EMISSION SPECTROSCOPY
K.L. Andrew, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (PHY79-08644)

Research in atomic physics will combine theoretical and experimental approaches to study the spectra of heavy atoms and compare it with the predictions of Slater-Condon theory. The new techniques of Fourier spectroscopy will be employed.

This research is a continuation of that previously supported under NSF grant PHY77-02087A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0017, INTERMEDIATE VALENCE PHENOMENA IN SOLID SOLUTIONS OF SAMARIUM SULFIDE
J.W. Schweitzer, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (DMR77-26410 A01)

The phenomenon of intermediate or 'mixed' valence associated with rare earth ions in certain compounds and alloys will be studied. Emphasis will be given to the study of the magnetic properties of these materials. There will be a systematic study of solid solutions of SmS with various samarium monopnictides where there is evidence for a chemically induced state of mixed configuration associated with the Sm ions. The lattice parameters, magnetic susceptibility, resistivity, and Hall constant will be measured as a function of temperature. A theoretical study of configuration mixing will be carried out to develop a description for the chemically-induced transitions and magnetic properties.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, THEORY OF ATOMIC STRUCTURE
B.R. Judd, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (PHY77-22488 A01)

Research in theoretical Atomic Physics initiated under NSF grant PHY73-05195 A03 will be continued. Analyses will concentrate on atoms and ions in various environments and external fields, particularly those produced by lasers. The principal topics of study are (a) The Jahn-Teller effect for trapped electrons or for ions at sites of various symmetries in crystals; (b) Correlation crystal fields for Lanthanide ions; (c) Quantum optics, with emphasis on multiphoton ionization; (d) Autoionizing states in highly ionized atoms; (e) Lifetimes of Rydberg states; and (f) Photoionization cross-sections. The aim of the work is to improve our understanding of the fundamental processes inherent in atomic systems and to develop the relevant mathematical techniques.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, STRONG LANGMUIR TURBULENCE IN MAGNETIZED SPACE PLASMAS
C.S. Liu, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (ATM78-25248)

This grant will support a computer study of the collapse of plasma waves in a magnetic field excited by electron beams or intense electromagnetic radiation. This work will use computer codes already produced for laboratory plasmas. The application will be space plasmas, e.g., auroral streamers, type III solar radio bursts and electron streams in solar flares. This will lead to a study of the nonlinear physics associated with the wave collapse process. In particular, the following will be studied: (a) evolution of wave collapse; (b) the final steady state of such a wave collapse; (c) the turbulent spectrum of plasma waves.

Finally, detailed comparison between theory and observation will be made.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0020, COSMIC RAY SPECTRA AND INVESTIGATION OF THE TIME STRUCTURE OF THE HADRONIC COMPONENTS OF AIR SHOWERS
R.W. Ellsworth, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (PHY79-09272)

This project consists of two parts. The first is a direct measurement of the energy spectrum of primary cosmic ray protons in the energy range 100 to 50,000 CeV. This uses a balloon-carried spectrometer, an ionization calorimeter, to measure energies. In the other experiment, which is ground-based at sea level, they study the cascade of particles produced by high energy cosmic ray particles striking the atmosphere - an extensive air shower. This group will measure the energies and relative arrival times of protons and other nuclear particles with respect to the very fast particles of the cascade. They have learned from previous experiments that this time structure is sensitive to the presence of heavy nuclei (e.g., iron) in the primary composition, at extremely high energies. This experiment will find the relative magnitude of the primary iron component at energies up to 50 million GeV. These data will provide crucial tests of theories of the origin and propagation of cosmic rays.

In addition, their sea level experiment is sensitive to the production of new massive elementary particles, since these will be delayed and also carry considerable energy. Some evidence for such production has already been found in smaller scale experiments. Confirmation of the existence of new massive states would be an important development in the understudy of fundamental components of matter.

This is the first year of a three-year continuing grant, previously supported under NSF grant PHY77-01438 A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0021, THEORETICAL STUDIES OF GRAVITY
C.W. Misner, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (PHY79-09281)

Theoretical research in physics will be done on topics in field theory which bear on gravity physics and on elementary particle physics.

The principal area of research currently contemplated is the development of non-linear quantum field theories (Harmonic Maps) that model a type of gravitational non-linearity different from that modelled by Yang-Mills theories. These theories also incorporate a style of symmetry breaking that occurs in general relativity (where local GL(4,R) symmetry is broken by the metric to give local Lorentz invariance), and the possible employment of this style of symmetry breaking in particle physics will be surveyed. Other problems will also be studied when they seem apt for solution and significant for a fundamental understanding of gravity and its relationship to the rest of physics or astrophysics.

This is the first year of a two year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0022, LABORATORY INVESTIGATION OF TWO IMPORTANT REGIONS OF THE ATMOSPHERIC SPECTRUM
W. Benesch, University of Maryland, College Park Campus, School of Engineering, Dept. of Physical Science & Technology, *College Park, Maryland* 20742 (ATM79-01040)

This grant funds a research program directed to the study of Laboratory spectra considered necessary for the support of observational and theoretical investigations of the aurora. Particular emphasis is placed on the ultraviolet and infrared as regions currently receiving special attention on the basis of evolving technology.

This program consists of a group of related experiments to elucidate the atomic and molecular processes which lead to auroral and airglow emission in the 2000 A and the 1 to 2 micron wavelength regions. Emphasis will be placed on the low-lying excited states of the nitrogen molecule, N2, and the nitrogen molecular ion, N2. The investigations will encompass molecular structure, transition probabilities, and excitation mechanisms. The wave-length regions to be studied are the vacuum ultraviolet and the near infrared beyond the reach of the photographic plate. The work will be carried out using the spectroscopic facilities (notably the 5-meter spectrographs) of the University of Maryland and Johns Hopkins University.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0023, COMPOSITION AND ELECTRONIC STRUCTURE OF ALLOY SURFACES
R.L. Park, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DMR7900323)

Research previously supported by DMR-7684576.

A study of metal and alloy surfaces using novel core level probes will be carried out to determine the interaction between the constituents of alloys in the surface region and surface energy effects and absorbed gas layers. Understanding the electronic structure of such complex systems requires surface probes that are capable of separately examining the electronic states of each constituent element. The basic tool in these studies is appearance potential spectroscopy, which measures the probability for inelastic electron scattering from core state electrons. In the past, appearance potential studies have focused on spectral features near the scattering thresholds, which are related to the conduction bond density of states. However, fine structure can be observed extending hundreds of electron volts above the thresholds. This structure, which is analogous to X-ray absorption fine structure, provides information on the bonding geometry in the surface region. The study will also involve more conventional probes such as low energy electron diffraction and Auger electron spectroscopy.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0024, PHASE TRANSITIONS AND CRITICAL PHENOMENA
J.V. Sengers, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics, *College Park, Maryland* 20742 (DMR79-10819)

A joint theoretical-experimental research program will be carried out in the area of phase transitions and critical phenomena. Attention will be given to studies of fluctuations in systems exhibiting critical points and the effects of these fluctuations on a variety of physical properties. Specifically, the crossover of the scaling properties immediately near the critical point to mean-field behavior far away from it will be investigated both theoretically and experimentally. Simultaneous neutron and light scattering data for the same system (deuterated isobutyric acid-heavy water) will be obtained in order to relate the correlation function to critical parameters. Thermal conductivity and viscosity of liquids near the gas-liquid critical point will be investigated to relate them to theoretical scaling predictions. Finally, spinodal decomposition of a binary liquid mixture (3-methylpentane-nitroethane) will be studied using a novel pressure-quenching technique.

This research previously supported by DMR 7682345 A01.
This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, STRUCTURAL STUDIES OF LIQUID CRYSTALS
R.B. Meyer, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (DMR79-15149)

This project is concerned with the first quantitative measurement of the fundamental defect structure of smectic A liquid crystals. A number of observations on the fluid properties of these materials had suggested that dislocations must be present, but these defects have first been seen by Dr. Meyer only in the last year. Such information is essential for understanding the fluid and mechanical properties of smectic liquid crystals, whose potential for use in display technology is just being appreciated. It is expected to be useful also for understanding dislocations in general, including magnetic flux quanta in superconductors and vortices in superfluid helium. The ability to see these defects in samples at equilibrium by non-invasive techniques, and to watch their response to known applied stresses is unique.

The dislocations are made visible as phase boundaries at the smectic A-smectic C transition. Precisely controlled stresses are applied to the sample, and the resulting strains and dislocation response are measured. A time-lapse video recording method allows analysis of the dislocation dynamics. The experiments are aimed at measuring dislocation energy and mobility, pinning effects, interdislocation interactions, and coupling to fluid flow. Measurements will be made also as a function of smectic A ordering approaching the smectic A-smectic C-nematic multicritical point. Finally, the dislocations will be used to attempt to make visible small steps on otherwise perfect surfaces.

First year of a three-year continuing grant; renewal of work supported by DMR76-22452.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, GROWTH OF RUBY CRYSTALS BY THE HEAT EXCHANGER METHOD
C.P. Khattak, Crystal Systems Inc., *35 Congress St., Salem, Massachusetts* 01970 (DAR79-17180)

Solid-state laser systems are presently being considered for laser fusion applications. Two of the main obstacles in this area are the availability of large size crystals and uniform dopant distribution. This research is directed to grow ruby crystals by the Heat Exchanger Method (HEM) for laser applications. At the present time ruby is grown commercially in sizes up to one inch diameter. Besides lack of availability of large sizes, the distribution of chromium dopant in the crystals is non-uniform, making it difficult for use in stringent optical applications. In the HEM process, crystal growth occurs under stabilizing temperature gradients with no movement of crystal, crucible or heat zone. The solid-liquid interface is submerged and surrounded by the melt; therefore, very uniform temperature gradients exist at the interface. These features allow uniform distribution of dopant, homogeneity in grown crystals and controlled cool-down to minimize normal stresses and prevent shattering.

During the proposed Phase I, it is intended to grow three-inch diameter ruby crystals by HEM and concentrate on the evaluation of crystal quality, distribution of chromium dopant, and uniformity of refractive index. Samples will be tested at the Lawrence Livermore Laboratory for stringent optical quality. The feedback from the quality assurance will be used to improve crystal growth process to achieve the desired objectives.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Applied Research

8.0027, NUCLEAR RESONANCE
R.V. Pound, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DMR79-07023)

Nuclear resonant techniques such as nuclear magnetic resonance (NMR), nuclear quadrupole resonance (NQR), and Mossbauer spectroscopy provide a means for measuring extremely small changes in energy. In this project, Mossbauer and NQR techniques will be employed in order to develop a spectroscopy for examining energy shifts in zinc-67 and tantalum-181 which have extremely narrow resonant line shapes. Thus, these isotopes offer the most sensitive opportunities for observing small energy shifts.

Tantalum-181 will be used to extend the measured accuracy of the gravitational red shift of the nuclear gamma rays. A flat glass wave guide will be constructed in order to transport the radiation from the source to the absorber--effectively focusing the radiation on the absorber.

High field, low temperature NMR experiments on solid hydrogen will be carried out in order to study the dynamic polarization of the nuclei. Phases of purely nuclear ordering in the solid will be sought.

This is the first year of a three-year continuing grant.

This research was previously supported under DMR 7684497 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0028, INVESTIGATION OF ATOMIC AND MOLECULAR PROCESSES WITH MODERN PREVISION SPECTROSCOPY
A. Javan, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (PHY79-14521)

This research program covers a broad area of investigation of basic atomic and molecular processes, as well as research relating to novel laser technologies. An important part of the program will be further work in the area of electron tunneling spectroscopy of submicron tunneling junctions (relating to novel quantum electronic applications). In a different area, near UV laser spectroscopy will be performed utilizing novel intense monochromatic frequency tunable UV gas laser sources. Other work of the laboratory will consist of laser-initiated-chemistry (in the IR and the visible range), nonlinear Doppler free spectroscopy, energy transfer and molecular relaxation studies, upconversion of an optical field and several long-term projects in the specified areas.

This research is a continuation of that previously supported under NSF grant PHY77-18761A02.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0029, ATOMIC AND MOLECULAR PHYSICS
G. Victor, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31A-4A50-01)

Methods and computation programs have been developed for constructing theories and models of the basic atomic and molecular processes in the creation, generation, and dissipation of energy. This theoretical research helps establish the parameters for study of terrestrial, stellar, and planetary atmospheres, as well as the interstellar and intergalactic mediums.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

8.0030, NUCLEAR STRUCTURE THEORY
K.T. Hecht, University of Michigan, Ann Arbor Campus, School of Liberal Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY77-15273 A01)

This work is in the field of theoretical physics with emphasis on the study of the nucleus.

Group theoretical techniques and SU(3) recoupling technology are being exploited in various applications to nuclear structure problems: (1) Symplectic SP(6,R) symmetry and SU(3) symmetry are being used in a study of the decay modes, structure, and fragmentation of isoscalar giant quadrupole resonances in nuclei in the A equals 12-40 range. (2) The fine structure and decay properties of the 12C plus 12C molecular resonances are being studed in a microscopic framework with emphasis on branching ratios into decay channels 12C plus 12C, 16O plus 8Be, 20Ne plus S, 23Na plus p,...(3) By combining SU(3) recoupling and Bargmann-Segal integral transform techniques, new methods are being developed for nuclear cluster problems with emphasis on multi-cluster problems and systems of binary clusters made up of heavy fragments. (4) A microscopic study of band crossing, backbending, and rotational alignment phenomena in heavy deformed nuclei in a shell model framework is made possible by combining normal parity shell model configurations severely truncated in a pseudo-SU(3) basis with wrong-parity high-j intruder configurations.

This work is a continuation of that currently supported under NSF grant PHY77-15273.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0031, ACOUSTIC MEASUREMENTS OF THERMAL AND MOMENTUM ACCOMMODATION COEFFICIENTS
D.F. Shields, University of Mississippi, University Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *University, Mississippi* 38677 (DN875606; N00014-78-C-0583)

To study gas-surface interactions and especially to measure the energy and tangential-momentum accommodation coefficients at the surface. The proposed measurements of energy and momentum accommodation coefficients are relevant to Navy problems such as calculation of drag coefficients on satellites and space vehicles and calculation of heat transfer and pumping speeds in rarified gases.

It has been shown that the velocity and absorption of sound waves propagated through a low pressure gas confined to a tube are changed significantly when adsorbed gas molecules are re-

moved from the tube wall. This phenomena is used as a basis for developing a method for simultaneous measurement of the energy and tangential-momentum accommodation coefficients.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0032, A STUDY OF THE COSMIC-RAY MODULATION USING GROUND-BASED NEUTRON MONITORS AND SPACECRAFT COSMIC-RAY DETECTORS
J.A. Lockwood, University System of New Hampshire, University of New Hampshire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM77-08971 A01)

This grant supports a study of the cosmic-ray modulation near the onset of the new solar activity cycle (21). Cosmic-ray data will be drawn from neutron monitors, Pioneer spacecraft cosmic-ray telescopes, IMP cosmic-ray monitors and the new cosmic-ray telescope on Voyager. The continued operation of the Mt. Washington neutron monitor will provide coverage through the beginning of the new cycle and the necessay baseline data for these studies. The first objective is to study the relationship between the cosmic-ray intensity at various distances outward from the earth (1AU to approximaely 15 AU) and the relationship between the observed Forbush decreases and the 11 year variation. The second objective is to continue a study of the large ground level enhancements on May 7, 1978, and November 22, 1977. In the May event, the large anisotropy, rapid onset, and hard rigidity spectrum make it an ideal event to test ideas about energetic solar particle events. The third objective is to investigate the large Forbush decreases on February 14, 1978, and April 30, 1978, to sharpen the detailed features of a physical model proposed for Forbush decreases. Fourth, from the investigaion of transient variations at large distances from earth it should be possible to develop more fully the model for Forbush decreases.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0033, THEORETICAL PHYSICS
J.D. Bahcall, Inst. for Advanced Study, *Princeton, New Jersey* 08540 (PHY79-19884)

Research will be performed in several areas of theoretical physics, including astrophysics, relativity, and particle physics. The astrophysics group will emphasize problems in stellar dynamics, including galaxy stability, the characteristics of disks, and the evolution of many-body systems, as well as studying aspects of X-ray sources, stellar evolution, the interstellar medium, and extragalactic phenomenology. Work will continue in the area of relativity including especially supergravity and classical fermion solutions. Some possibly related aspects of gauge field theory in particle physics will also be investigated.

This is the first four months of a forty month grant, previous research supported under NSF grant PHY77-20612.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0034, QUANTUM SOLIDS AND THIN HELIUM FILMS AT LOW TEMPERATURES
J.G. Daunt, Stevens Inst. of Technology, Graduate School, Dept. of Physics & Engineering Physics, *Castle Point Station, Hoboken, New Jersey* 07030 (DMR77-09938 A01)

This research is a continuation of work supported under NSF Grant No. DMR-7709938. The experimental program encompasses two broad areas: a) NMR techniques will be used to study phase changes occurring in solid hydrogen, with low ortho-concentrations, at or below 0.3K, and b) Adsorption isotherm techniques will be used in studies of the phase changes occuring in two-dimensional helium-3, hydrogen and deuterium films adsorbed on substrates at low temperatures.

These latter measurements rely on the use of a recently developed low-temperature, high-precision capacitance pressure gauge.

This work will lead to an increase in fundamental knowledge about solid state phase changes in quantum solids as well as the role which reduced dimensionality plays in such transitions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, USE OF MOSSBAUER AND OTHER SPECTROSCOPIES IN STUDIES OF ELECTRONIC AND VIBRATIONAL STRUCTURE
G.M. Rothberg, Stevens Inst. of Technology, Graduate School, Dept. of Physics, *Castle Point Station, Hoboken, New Jersey* 07030 (DMR79-08546)

The electronic and vibrational structure in solids will be studied by means of conversion electron Mossbauer spectroscopy (CEMS) and other electron spectroscopies. Through observation of photoelectrons and of internal conversion electrons produced in radioactive decay or after Mossbauer absorption, new kinds of experiments are possible. Measurements of electron spin densities in magnetic materials, dealing with fundamental aspects of magnetism in solids as manifested by core and conduction electron spin polarizations, will be continued. Work will also be carried out on the depth dependence of the Mossbauer effect in which the energy loss by the conversion electrons or auger electrons in traversing the Mossbauer absorber is used to determine the depth at which they were produced.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, ITINERANT ELECTRON ANTIFERROMAGNETISM AND LOCALIZED MAGNETIC MOMENTS
S. Arajs, Clarkson College of Technology, Graduate School, Dept. of Physics, *51 Main St., Potsdam, New York* 13676 (DMR76-09198 A01)

Magnetization and resistivity experiments will be carried out on chromium alloys with iron, cobalt and manganese. This research is directed at increasing our understanding of localized magnetic moments in an itinerant electron antiferromagnetic matrix. The results may be important for the related areas of spin glasses and mictomagnetism.

This research was previously supported under DMR 7609198.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, MODEL SYSTEMS
B. McCoy, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (DMR79-08556)

Research previously supported by DMR7707863.

Theoretical research on systems with an infinite number of degrees of freedom will be carried out, including both statistical mechanical systems and quantum field theories. In particular, the recently calculated n-spin correlations of the two-dimensional Ising model at zero magnetic field will be used to extend the studies of both spin correlation and free energy for non-zero field both below and above the critical temperature. Also, the two-dimensional Heisenberg model and four-dimensional gauge theories will be investigated. The emphasis will be on obtaining exact results on the properties of these systems.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0038, COMMUNICATIONS - DISORDERED SOLIDS
D.G. Haase, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (DN975200; N00014-79-C-0133)

This work involves investigation of a model system for disorder in solids. Future naval systems for communication and information storage may utilize disordered materials.

The pressure and specific heat of solid hydrogen will be studied as a function of temperature and orthohydrogen concentration in a regime where it serves as an analogue of spin glass.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0039, ELECTRON EMISSION CROSS-SECTIONS OF ATMOSPHERIC GASES FOR THE VACUUM ULTRAVIOLET LIGHT STANDARD PROJECT

J.S. Risley, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (ATM77-19643 A02)

The grant funds research on secondary absolute light standards for the calibration of monochromators in the vacuum ultraviolet region (500-1500A) and extreme ultraviolet region (50-500A). The basic concept of the light standard relies on the fact that line radiation is emitted when an energetic beam of electrons passes through a gas. If the emission cross-section for a line is known for a particular electron impact energy, the flux of radiation can be determined from the current of electrons and the density of the target gas. Using the well-parametered synchrotron radiation from the NBS storage ring as the primary absolute light source, the sensitivity of a monochromator will be calibrated from measuring numerous emission cross-sections relevant for a secondary light standard. Initially, the overall accuracy of the emission cross-sections is expected to be better than 15 percent with a long-term goal of 2-5 percent depending on the transition. The vacuum ultraviolet light standard project ultimately should lead to the development of a highly useful tool for a broad range of scientists working with vacuum ultraviolet radiation. This proposal, specifically, is concerned with measuring the electron emission cross-section for VUV light (500-1500A) emitted by gas targets of O2, N2, NO and H2O.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0040, THERMAL AND OPTICAL STUDY OF LIQUID CRYSTAL PHASES AND PHASE TRANSITIONS

D.L. Johnson, Kent State University, School of Arts & Sciences, Dept. of Physics, *Hilltop Dr., Kent, Ohio* 44240 (DMR7906330)

Liquid crystals are well known because of their widespread use in display devices (as in pocket calculators) and temperature indicators. The present interest, however, is primarily scientific. This experimental program is designed to reveal the positions occupied by the various liquid crystal phases (also called 'mesophases') in the hierarchy of phases of condensed matter and to provide new challenges to the modern theory of critical phenomena and phase transitions. The information obtained should be useful, also, in providing guidance for construction of molecular theories of liquid crystal behavior.

The experiments are primarily high resolution a.c. (alternating current) microcalorimetry measurements of heat capacities and transition entropies associated with liquid crystal phase transitions, complemented by selected light scattering and magnetic measurements. In designing each set of experiments, the authors have assumed as a working hypothesis that the various liquid crystal phases belong to certain more general categories of phase of condensed matter known as universality classes. Where there have been predictions of the appropriate universality class, experiments are chosen that offer a definitive test of these predictions. The primary emphasis is on the nematic-smectic A, smectic A-smectic C, nematic-smectic C, smectic A (or C)-smectic Bt (tilted) phase transitions and on certain special critical points called multicritical points.

First year of three-year continuing grant; renewal of work supported by DMR76-21346.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0041, POSSIBLE QUANTUM CROSSOVER EFFECTS IN PURE FLUIDS NEAR THEIR CRITICAL POINTS

M.H. Chan, University of Toledo, School of Arts & Sciences, Dept. of Physics, *2801 W. Bancroft St., Toledo, Ohio* 43606 (DMR7825014)

A high-precision, systematic study of the equation of state of oxygen, argon, para-hydrogen and deuterium fluids will be carried out in the vicinity of the respective critical points. In order to investigate the predicted 'quantum-crossover' effect, three different critical exponents will be obtained in two concurrent experiments based on the use of cryogenic sample cells containing small parallel plate capacitors filled with the fluid under investigation. Measurements of the dielectric constant in the one and two phase regions allow one to derive the isothermal compressibility, density differences and isotherms of the various fluids from which their critical exponents are derived. This study will provide a definitive test for the existence of the quantum crossover phenomenon and as such is important for our fundamental understanding of quantum liquids.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0042, VELOCITY AUTOCORRELATION

Y.W. Kim, Lehigh University, School of Arts & Sciences, Dept. of Physics, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (PHY79-09267)

This project studies the details of the behavior and properties of gasses at the molecular level, and measures the microscopic fluctuations and persistences of motion that, integrated, make up the macroscopic properties. An experimental program of determining the persistent velocity autocorrelation function for Brownian and molecular fluctuations will be continued. The velocity autocorrelation function is measured directly for Brownian motion as a function of gas density by a new technique currently set up for measuring particle positions at the rate of 100 MHz and up to 8 million times per run. In a second experiment, consequences of the persistent velocity autocorrelation for molecular motion are investigated by studying pulsed plasmas undergoing decay in very dense hydrogen and argon.

This research is a continuation of that currently supported under NSF grant PHY77-07858A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0043, TIME-OF-FLIGHT AND OPTICAL STUDIES OF THE ELECTRON-IMPACT EXCITATION AND DISSOCIATION OF MOLECULAR GASES OF AERONOMIC INTEREST

E.C. Zipf, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (ATM78-20538)

We have learned during the past several years that much of the chemistry and energetics determining the nature of the upper atmosphere depends importantly upon atmospheric particles not in their ground-level state, but in excited states. Our need for this knowledge has motivated a set of research activities in the difficult, and intricate, but necessary area of laboratory studies tracing the evolution of specific states of reactant species.

This grant funds a series of complementary experiments that will bring us significantly closer to the goal of completing our knowledge of the fundamental ways in which N2 and O2 dissociate, at providing a comprehensive set of absolute cross-sections for each loss channel, and at studying in detail the aeronomic consequences of the excited species produced by dissociation induced by electron impact and by EUV photo-absorption.

Specifically, in this continuing effort, experiments will be carried out which exploit optical and Time-of-Flight techniques: (1) to measure absolute optical cross-sections for the interpretation of airglow and auroral data in the wavelength range 400A to 1.5 micrometer; (2) to determine the identity of the final atomic and molecular species with particular emphasis on such

metastable species as N(2D), N(2P), O(1S), O(1D), and N2(A3 plus sigma micron units) which play an important role in the overall thermal economy of the upper atmosphere and in its ion and neutral chemistry; (3) to measure the kinetic energy distribution of the "hot" atoms and ions produced by a variety of dissociative processes with particular interest in the effects of these processes on enhanced exospheric escape and on accelerated ion and neutral chemistry caused by hot atoms.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0044, ATOMIC AND MOLECULAR PHYSICS
L.G. Christophorou, U.S. Dept. of Energy, Oak Ridge National Lab., Health & Safety Research Div., *Oak Ridge, Tennessee* 37830 (00722; W-7405-ENG-26)

The objectives are to: (1) study in detail the elementary processes which accompany the interaction of radiation with matter; (2) investigate the effects of the nature and density of the environment on the elementary photophysical and charge transfer properties of biomolecules and the elementary processes that accompany the interaction of radiation (ionizing and non-ionizing) with matter; and (3) link the physical and chemical properties of biomolecules in gases with these in the condensed phase. Quantitative and integrated experimental and theoretical studies on low-energy electron-molecule interaction processes, negative ions, electron transport and photoionization of molecules in low- and high-pressure gases in liquids will be employed to obtain this objective.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

8.0045, 1 MM WAVELENGTH OBSERVATIONS OF SOUTHERN HEMISPHERE SOURCES
J.J. Condon, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Physics, *Blacksburg, Virginia* 24061 (INT79-10830)

Under this award three U.S. physicists and astronomers, James J. Condon of Virginia Polytechnic Institute and State University, and James R. Houch and T. Roellig of Cornell University, will work from August through September 1979 with Australian colleagues, principally J.G. Bolton and D.L. Jauncey of the CSIRO Division of Radiophysics and K.H. Elliott of the Anglo-Australian Observatory, on a program of astronomical observations of the southern skies at wavelengths near one millimeter. The southern heavens contain a wealth of objects of astrophysical interest that are inaccessible to northern observatories and remain virtually unexplored at wavelengths near alpha equals 1 mm. In order to carry out the collaborative observations, the Americans will take with them a helium-3 bolometer to be installed on the 3.9 meter optical Anglo-Australian Telescope (AAT) on Siding Spring Mountain in New South Wales. The objects to be observed at 1 mm wavelength include the galactic center, the Magellanic Clouds, variable X-ray/radio sources (e.g., Cir X-1 and Sco X-1) and several Seyfert galaxies, QSOs, BL Lac objects, etc.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0046, EQUIPMENT FOR RESEARCH ON QUANTUM THEORY OF MOLECULAR SCATTERING
K. Tang, Pacific Lutheran University, School of Arts & Sciences, Dept. of Physics, *P.O. Box 2068, Tacoma, Washington* 98447 (PRM79-21430)

This research equipment grant makes it possible to establish a computer RJE terminal at Pacific Lutheran University for Dr. K.T. Tang to carry out his research in theory of molecular scatterings. This research is centered on the adiabatic distorted wave model and the polarized target coupling model. Based on T-matrix formalism of the quantum theory of scattering, these approaches couple the incident atom with target molecule and thus are realistic three-dimensional methods. In certain cases, extensive calculations can already be carried out; in others, developments which are also essentially computational are needed. An RJE terminal connected with the National Resource For Computation in Chemistry at Lawrence Berkeley Laboratory will make this work possible.

SUPPORTED BY U.S. National Science Foundation, Office of Planning & Resources Management

8.0047, TOPIC IN THE THEORY OF TRANSITION-METAL SURFACES AND APERIODIC MATERIALS
J.J. Rehr, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR79-07238)

Research previously supported by DMR7682112. Aperiodic materials are those which lack the periodic translational symmetry that simplifies the theory of crystalline solids; these include solids with surfaces or impurities or disorder, etc. This research consists of three topics which deal with such systems from a local-environment viewpoint: (1) The theory of the Extended X-ray Absorption Fine Structure (EXAFS) deals with a new experimental technique for determining local atomic structure in aperiodic materials. Two factors which reduce EXAFS amplitudes in solids will be studied: the many-body 'shake-up' and 'shake-off' processes, and the Deby-Waller factor. These studies should improve the determination of coordination numbers and vibrational structure from EXAFS. (2) The second topic is a generalization of the recursion method, a recently developed theoretical technique for determining local electronic structure in aperiodic materials, permitting in addition, calculations of the electron density. An application calculation of the d-electron contributions at noble and transition metal surfaces will be carried out. (3) A final topic is the theory of sub-monolayer helium films, physisorbed on rare gas overlayers. A new tight-binding theory which makes use of the recursion method to calculate the low-temperature thermodynamics of these quantum systems will be evaluated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, REFURBISHMENT OF THE LUNATIC MASS SPECTROMETERS
G.J. Wasserburg, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Sci, *1201 E. California Blvd., Pasadena, California* 91109 (EAR77-26082)

The proposal is a request for funds to upgrade two mass spectrometers. The spectrometers are twelve-years old and need thorough overhauling, since now they have a down time of about 50%. The major causes of failure lie in the electronic systems. The projects that will make use of the spectrometers include: 1) determination of the primitive isotopic composition of Sr in the early solar nebula; 2) determination of the Rb-Sr and U-Th-Pb ages of stoney and iron meteorites; 3) discovery of extinct 26-Al; 4) measurement of neutron capture effects in meteorites and in lunar materials; 5) determination of the chronology of the moon; 6) application of the new Sm-Nd dating technique to lunar and terrestrial samples.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

10.0002, THEORETICAL INVESTIGATIONS OF X-RAY SOURCES
J. Arons, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST78-21070)

This project will be concerned with theoretical investigations of galactic X-ray sources. The model to be adopted is one in which the observed X-ray emission is due to the infall of

matter onto a magnetized, rotating neutron star in a binary system. Within the context of this model, there will be studies of neutron stars with slow, medium and fast rotation rates in an effort to model the observed sources. The models that are obtained will be compared with observational data in order to gain insight into the origin and evolution of neutron stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0003, OBSERVATIONAL AND THEORETICAL STUDIES OF PRE-MAIN SEQUENCE EVOLUTION
L.V. Kuhi, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST79-02866)

This research will make use of the current spectroscopic data that exist on the very young stars to construct models for the atmospheres of such stars and for the interaction of their winds with the surrounding interstellar medium.

The stars to be studied are known as T Tauri stars. They are found in dark clouds and must be very young. It appears that they are still in a stage of contracting towards the main sequence and are among the youngest objects that can be considered stars. The stars have a mass similar to that of the sun.

The models to be constructed will be based on an approach where it is assumed there is a chromosphere that begins deeper in the atmosphere and has a steeper temperature rise than the solar chromosphere which is responsible for the observed emission features. A global, self-consistent stellar wind model will be constructed. Comparison will be made with observations of emission line intensities in the nebula surrounding the young star T Tauri. Further observations will be undertaken to determine the time scale on which emission features in T Tauri stars vary.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0004, MAGNETIC STRUCTURES AND FIELD RECONNECTION - MECHANISMS OF SOLAR-TERRESTRIAL ACTIVITY
G. Van Hoven, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (ATM79-11912)

The present program has a number of related objectives. They include a study of energy-transport and resistivity-transition effects on magnetic tearing, with application to phase changes in flares. The influence of finite boundaries and thin turbulent sheets on the resistive stability of coronal loops will also be investigated. The recent thermal-instability calculation will be extended to include other parameter ranges and some presently neglected physical effects. Finally, an attempt will be made to devise a new, more detailed method for the computation of small-scale force-free fields.

The long-term aim of this research is the synthesis of a comprehensive description of the resistive and radiative instabilities of a sheared magnetic field, which will then represent a nearly complete flare model, and to predict empirical tests which will demonstrate its reality. The impending Solar Maximum (spacecraft) Mission represents a unique focus for this program.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0005, THEORETICAL NUCLEAR ASTROPHYSICS
S.E. Woosley, University of California, Santa Cruz Campus, Lick Observatory, *Mount Hamilton, California* 95140 (AST79-09102)

This research will be devoted to a numerical study of stars having masses in the range of fifteen to one million solar masses. This study will analyze the evolution of these stars and the role such objects, especially supernovae, may have played in creating the elements heavier than helium. The detailed nucleosynthesis resulting from the normal evolution and explosion of stars having masses 15, 20, 25, 35, 50, 100, and 150 times that of the sun will be studied. In addition the collapse and possible explosion of supermassive stars (having masses in the range of one hundred thousand to one million solar masses) will be examined using one- and two-dimensional hydrodynamic computer codes that contain the detailed nuclear physics appropriate to such events.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, THEORETICAL INVESTIGATION OF THE INVERSION OF INFRARED SOLAR OCCULTATION MEASUREMENTS
D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics & Astronomy, *2115 S. University Blvd., Denver, Colorado* 80210 (9-315; NA79AA-D-00021)

OBJECTIVES: To develop theoretical techniques for inverting satellite infrared solar occultation measurements to obtain distributions of concentrations of trace gases in the stratosphere.

APPROACH: The University of Denver will simulate the response of a multi-channel radiometer viewing the setting sun through the earth's atmosphere. They will develop mathematical techniques for inverting response-versus-viewing angle curves to obtain concentrations of trace gases in the stratosphere. This work includes the development of simple and accurate models for computing the absorption by such gases as nitric acid, freons, water vapor, and ozone in limb paths.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., National
Environmental Satellite Service

10.0007, RELATIVISTIC ASTROPHYSICS AND GRAVITATION THEORY
D.M. Eardley, Yale University, School of Arts & Sciences, Dept. of Physics & Astronomy, *206 Elm, New Haven, Connecticut* 06520 (PHY79-16482)

Theoretical research in relativistic astrophysics initiated under NSF grant PHY76-82353A01 will be continued. Among the topics to be investigated are: 1. Gravitational Collapse; a) pertubations of spherical collapse; b) ellipsoidal models; c) growth of asymmetry during core bounces; d) nonaxisymmetric numerical relativity. 2. Global Analysis of Gravitational and Yang-Mills fields; a) linearization stability; b) singularities and maximal slices. 3. Black Holes and Gravitational Waves; 4. Source and Detection of Gravitational Waves; a) pulsars as sources and detectors; 5. Quantum Gravity.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

10.0008, IMAGE INTENSIFIER SYSTEMS
W.K. Ford, Carnegie Inst. of Washington, Dept. of Terrestrial Magnetism, *1530 P St. N.W., Washington, District of Columbia* 20005 (AST79-03432)

The cascaded image intensifier systems developed by the Carnegie Institution have had widespread success in obtaining many diverse types of astronomical observations. Among the advantages of this detector are relatively high efficiencies compared with photographic plates and a large number of picture elements compared with the presently available digital detectors. The image intensifier systems are simple to operate and require little maintenance for routine observatory operation. Early versions of these tubes have been used extensively at the Las Campanas Observatory and at the Lowell Observatory. Systems incorporating more recently produced tubes are heavily scheduled at the Kitt Peak National Observatory, the Cerro Tololo Interamerican Observatory and on the duPont Telescope at the Las Campanas Observatory. This grant will provide for devel-

opment of a new, higher quality tube which will improve and enhance the observational capability of the present systems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0009, PHOTOMETRIC STUDIES OF ALGOL-TYPE BINARY STARS IN THE RED, NEAR INFRARED AND ULTRAVIOLET WAVELENGTH REGIONS
K. Chen, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Astronomy, *208 Tigert Hall, Gainesville, Florida* 32601 (AST78-07169 A01)

Support is for observation and analysis of selected Algol-type eclipsing binary stars. In this type of close binary system, the primary (more massive) components are main sequence stars fitting well into the mass-luminosity relation. The secondary components are of later spectral type, overluminous for their mass and spectral class and, in general, fill their critical Roche lobes so that mass exchange is usually underway. The planned red and infrared photometric observations will contribute to a better understanding of the cooler secondary components and the geometric and photometric elements of the systems.

Spectrometric data on Beta Persdi (Algol) in the ultraviolet were obtained jointly with F. B. Wood as guest investigators on the Copernicus satellite. Identification of ultraviolet lines will be continued, and observed line profiles determined and compared with theoretical profiles at the partial eclipse phases to test the geometrical model of the Algol system.

The results of these investigations will be published along with tables calculated by J. E. Merrill for determining elements of eclipsing binaries with elliptic orbits.

Prior support was by NSF grant AST 78-07169.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, THE YERKES OBSERVATORY ASTROMETRIC PROGRAM
K.M. Cudworth, University of Chicago, School of Physical Sciences, Dept. of Astronomy & Astrophysics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (AST78-01657 A01)

A feature of the Yerkes program is the study of proper motions of stars in open and globular star clusters, important as indicators of the course of stellar evolution, as tracers of galactic structure, and as examples of dynamical systems in various states of relaxation. Their study also contributes to the calibration of the luminosities of various types of stars as well as the distance of the galaxy and the universe. The relative proper motions of cluster stars with sufficient accuracy to determine membership in such clusters will be continued. Pairs of plates made with the Yerkes long-focus 40-inch refracting telescope over a long base line in time will be used. Emphasis will be on globular clusters and the Ursa Minor dwarf spheroidal galaxy.

Another emphasis is on determination of the important parameter of distance of stars in the solar neighborhood through measurement of the parallactic shift of the stars as the earth circles the sun. The development of observing, measuring, and reduction techniques to substantially increase the accuracy of these trigonometric parallaxes will also be continued. Objects currently being observed include red dwarf stars, white dwarf stars, and stars in the Hyades cluster as part of an international campaign.

Prior support was by NSF grant AST 78-01657.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, THEORETICAL INVESTIGATIONS IN STELLAR DYNAMICS
P.O. Vandervoort, University of Chicago, School of Physical Sciences, Dept. of Astronomy & Astrophysics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (AST7821884)

The research deals with the development and numerical testing of theories of stellar orbits in galaxies, the study of galactic dynamics in terms of such theories, and the investigation of dynamical processes which depend on special properties of the orbits. Such investigations provide a fundamental understanding of the forms of galaxies and of the patterns of stellar motions in galaxies. They also provide a basis for the interpretation of computer simulations of galaxies. One part of this work concerns the contribution of resonant stars to the excitation and maintenance of spiral structure in galaxies. Detailed studies will be made of (1) the exchange of energy and angular momentum between resonant stars and spiral density waves or other nonaxisymmetric disturbances and (2) processes by which stars become trapped in resonant orbits. The second part of this research deals with the dynamics of rotating galactic bars. The principal effort will be devoted to the enumeration of the isolating integrals of the motion of stellar orbits and to the incorporation of the integrals into equilibrium models of galactic bars. The possibility will be investigated that resonant stars play an important role in the dynamics of galactic bars as is suggested by recent computer simulations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Astronomical Sciences

10.0012, RADIO AND OPTICAL STUDIES OF INTERSTELLAR CLOUDS
R.M. Crutcher, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST76-20810 A01)

This project is to study abundances and physical conditions in interstellar clouds. Three areas will be studied: 1) interstellar magnetic fields. A new approach is to be used which will give a factor of 10 higher sensitivity, namely using Zeeman splitting in the hydroxyl radical (OH); 2) excitation and abundance of the OH molecule. The possibility of anomalies in the strengths of the OH lines in the wavelength region of 18 centimeters will be investigated both observationally and theoreticaly; and 3) diffuse clouds by means of optical observations of interstellar potassium and lithium and the molecules CH ion and CH in stars which are much more highly reddened than those previously studied.

This research should lead to a better understanding of the physical conditions in interstellar clouds and the process of star formation.

This is a continuation of AST-7620810.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0013, HIGH RESOLUTION STUDIES OF SOLAR ACTIVE REGIONS, FLARES AND PROMINENCES AT CENTIMETER AND MILLIMETER WAVELENGTHS
D. Kundu, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (ATM78-21762)

This grant continues the use of existing large interferometers such as the Very Large Array (VLA), the Westerbork Synthesis Radio Telescope (WSRT), and the Mat Creek interferometer for making high resolution observations of solar active regions, flares and prominences at centimeter and millimeter wavelengths. It is intended to produce maps of active regions with high spatial resolution from observations over a period of 8-12 hours, using the VLA and the WSRT. These maps will provide information on the distribution of temperature (Te), (Ne) and magnetic field in active regions. Comparison of these maps with x-ray maps to be obtained from the Solar Maximum Mission with a resolution of a few arc seconds which give Te and Ne fairly accurately, should lead to a better understanding of the generating mechanism of radio emission from active regions and should result in a better estimate of coronal magnetic fields. It is also intended to study the increases in intensity and polarization in the active region core and identify them with specific features in soft x-rays, in order to understand better the flare build-up process. The spatial resolution will

answer the question of whether in a complex region the flaring kernel is the one that undergoes pre-heating.

The radio data will permit an understanding of the mechanisms responsible for the release of energy during the impulsive phase and the acceleration of electrons, and to determine the site of electron acceleration. In combination with hard x-ray data to be obtained from SMM they will also permit critical examination of the existing flare theories and X-ray flare models with particular reference to the magnetic field configuration.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Atmospheric Sciences

10.0014, MULTIPLE GEOSYNCHRONOUS SATELLITE OBSERVATIONS OF GEOMAGNETIC PULSATIONS

W.J. Hughes, Boston University, School of Liberal Arts, Dept. of Astronomy, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (ATM79-11899)

Geomagnetic pulsations, long considered an interesting phenomenon in their own right, are rapidly becoming important diagnostic tools for observing the state of the magnetosphere and solar wind. Their usefulness in this respect will be greatly enhanced by a better understanding of the mechanisms by which they are produced and by which they propagate in the magnetosphere and to the ground.

Early in this decade rapid advances in our understanding of pulsations were made by using chains of magnetometers along a line of constant longitude. These results led directly to the development of new theories of pulsation structure and the resonance of geomagnetic field lines, but an important parameter which helps distinguish between competing theories of pulsation production remained unmeasured. This parameter is the East-West wavelength of pulsations. Very recently a few measurements of East-West phase difference have been made, and both direction of propagation and East-West wave-length could be deduced. Some results fitted expectations but many did not and more work needs to be done. The research supported here will extend one of the earliest studies of East-West structure, and the only one made in space. A fortuitous grouping of three geosynchronous satellites equiped with similar magnetometers occured for three months in early 1975, and so formed a de facto East-West chain of magnetometers in space. An examination of data from six dayside passes has produced many new results. One of these is that the nightside appears to be an important source of many dayside pulsations, and this fact has been corroborated by recent results from a ground network. This grant permits a comprehensive analysis to address this question in particular. The aim is to provide insight into the major production mechanisms of geomagnetic pulsations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0015, MODEL ATMOSPHERES

R. Kurucz, Smithsonian Institution, Astrophysical Observatory, Solar & Stellar Physics Div, *60 Garden St., Cambridge, Massachusetts* 02138 (31S-4S50-03)

Analysis of solar photospheric rocket spectra of W. Parkinson, E. Reeves, and J. Kohl. The stages of the analysis are definition of a wavelength scale, identification of the lines, and finally comparison of the predicted intensities to those observed. Information should be forthcoming on the reliability of gf values, damping constants, photoionization cross-sections, abundances, solar models, and the rocket calibration.

Through spectral synthesis the analysis of rocket and satellite data for early stars was found to be much more complicated than has been generally assumed. Many of the observed features are, in fact, blends of a number of lines, so that simple analysis in terms of equivalent widths is not possible and detailed spectral synthesis is required.

A preliminary theoretical solar model photosphere was published and work is continuing on improving the line data which goes into the calculation.

In collaboration with J. Lester and A. Dupree, analysis of their stellar observations from the Copernicus satellite. Also guest investigator on Copernicus for observations of Vega and Sirius.

Production of a grid of line-blanketed model atmospheres for F, A, B, and O stars for a range of gravities down to the radiation pressure limit, for abundances 10, 3, 1, 1/3, 1/10, 1/30, and 1/100 solar, and for a range of microturbulent velocities. These models will be used to determine the variation of any observable quantity (colors, energy distributions equivalent widths, line profiles) with temperature, gravity, abundance, and microturbulent velocity. These models should resolve differences between galactic clusters, microturbulence in A stars, metallicity, and population differences.

Research on gf values for the iron group, gf values for interstellar lines, and a gf value compendium (with E. Peytremann).

Research on several aspects of the problems associated with calculating realistic line-blanketed model stellar atmospheres.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0016, REDEVELOPMENT OF THE CONTROL DATA CORPORATION-LUYTEN MEASURING ENGINE

R.M. Humphreys, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Astronomy, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (AST78-07961 A03)

The Control Data Corporation-Luyten measuring engine was originally developed to determine the positions of large numbers of stars. This supplement will provide funds to test its present performance, to determine the suitability of use of this instrument for more general astrometric problems such as the determination of colors and magnitudes of stars, star and galaxy counts, and pattern recognition (nonstellar images) problems and to move the measuring engine to the University of Minnesota.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0017, A THEORETICAL STUDY OF THE RR-LYRAE AND CEPHEID VARIABLE STARS

N.R. Simon, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Lincoln, Nebraska* 68508 (AST79-05290)

This research will be concerned with a theoretical analysis of variable stars. While most stars have a constant luminosity over long periods of time, there are several types of stars that are observed to be variable. This variation is periodic and, depending on the star, may range from a fraction of a day to several weeks. The physical origin of this change in the luminosity of a star is now known. Nevertheless, a number of problems still remain. In particular, different results for the masses of these stars are obtained from stellar pulsation theory as compared to stellar evolution theory. Some stars are observed to have two distinct pulsation periods. These periods cannot be reconciled with standard assumptions regarding evolution, pulsation and chemical abundances. This problem, plus related problems in stellar pulsation theory, will form the basis of this research project.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0018, STABILITY OF STARS AND CIRCUMSTELLAR FLOW

R.F. Stellingwerf, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (AST77-26993 A01)

The research to be carried out under this grant will involve the study of pulsation in different types of stars as well as the study of transient hydrodynamic phenomena in stellar objects. The topics to be studied include: 1. Work on nonlinear periodic pulsations and stability of the limit cycle of variable stars. The stars to be studied inclde lower Cepheid strip variables and Beta

Cepheid variables. 2. The analyses of the pulsation periods of variable star; 3. Linear and nonlinear analyses of protostellar collapse and transient X-ray sources. Application to stellar pulsation and stellar winds is planned.

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of Astronomical Sciences

10.0019, INVESTIGATIONS OF GALACTIC AND EXTRAGALACTIC RADIO FREQUENCY BURSTS

I.R. Linscott, Dudley Observatory, *69 Union Ave., Schenectady, New York* 12308 (AST79-11142)

Radio frequency bursts of galactic and extragalactic origin will be investigated using the dispersion deconvolution signal processing that has been recently developed. Preliminary observations to detect weak, highly dispersed radio bursts from the directions of Virgo A, and Sagittarius A at 327 MHz using a preliminary configuration of the dispersion signal processing have been made on Dudley Observatory's 30-meter diameter radio telescope. The current combination of hardware and software signal processing has a high sensitivity for radio bursts but a very low (10 to the minus 4th power) detection efficiency. The detection efficiency will be improved and searches will be made for additional sources of asynchronous radio bursts. Radio bursts carry information on the density and turbulence of plasmas both in the vicinity of the burst source and within interstellar or intergalactic clouds. The radio bursts then provide a singular opportunity to measure the physical conditions with these plasmas. The physical conditions will be estimated by measuring the plasma dispersion and scintillation constants of the individual radio bursts. These constants will be measured using a simple extension of the current deconvolution signal processing incorporating additional high speed arithmetic processing.

This is s continuation of AST-7807406.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0020, THE MASTER LIST OF NON-STELLAR OPTICAL OBJECTS

R.S. Dixon, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (AST78-24455)

The Master List of Non-Stellar Optical Objects (or Master Optical List, MOL) is the first systematic listing of all known non-stellar objects made since Dreyer published his final IC in 1908. All known catalogs (about 250) of non-stellar objects have been combined together into a single, uniform listing, having about 185,000 entries. The types of objects included are galaxies, clusters of galaxies, planetary nebulae, reflection nebulae, absorption nebulae, emission nebulae, blue objects, quasi-stellar objects, and many others. Each listing includes the name, position (1950.0), angular diameter, diameter, magnitude and type of object.

This work will be published by the Ohio State University press, and partial support of the publication is granted.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0021, LONG-TERM CONTINUOUS OBSERVATIONS OF LARGE SCALE MOTIONS AND STRUCTURES ON THE SUN

M.A. Pomerantz, Franklin Inst. of the State of Pennsylvania, Bartol Research Foundation, *Swarthmore, Pennsylvania* 19081 (DPP78-22467)

A solar telescope will be installed at the Amundsen-Scott Station at the South Pole at the beginning of the austral summer of 1979-1980. During the austral summers of 1979-80 and 1980-81 this instrument will be used to make an extensive study of: 1. the lifetime of supergranules on the sun, 2. the morphology of solar flares, and 3. the potential of the South Pole site for more technically complex solar observations. The detailed analysis of the data obtained will be performed during the third year of this grant.

Logistic support is required for three persons during the austral summer of 1979-80 and 1980-81.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

10.0022, THE CONSTRUCTION OF NEW ASTROMETRIC INSTRUMENTATION FOR THE DETECTION OF EXTRASOLAR PLANETARY SYSTEMS

G.D. Gatewood, University of Pittsburgh, School of Arts & Sciences, Dept. of Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (AST78-01662 A01)

The research to be carried out under this grant will be devoted to the development of a detector which will allow the relative positions of stars to be measured to a very high precision. The eventual precision of such a device would be such as to enable the detection of planetary systems around nearby stars. In order to attain such precision, a number of new engineering concepts must be tested. This project will involve construction of some instrumentation to test out some of the proposed methods.

This is a supplement to NSF grant AST 78-01662.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0023, AN INVESTIGATION OF THE PRODUCTION, RELAXATION, AND DISSOCIATIVE RECOMBINATION OF VIBRATIONALLY EXCITED IONS OF AERONOMIC IMPORTANCE

E.C. Zipf, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (ATM79-06920)

The compositional and thermal structure of the upper atmosphere depends importantly on the chemistry of its constitutent species formed in energy states other than the ground level state. We have much yet to learn about such chemistry.

This grant funds a program of research on the dissociative recombination of molecular ions of aeronomic importance. In this continuing effort experiments will be carried out that exploit newly developed laser-induced photofluorescence techniques: (1) To measure the dissociative recombination coefficients for specifically identified rotational and vibrational levels; (2) To determine the identity and absolute production rates of the important metastable species (e.g. N(2P), N(2D), O(1S), and O(1D) formed by this process as a function of the rotational and vibrational temperature of the ions and the electron temperature of the plasma; (3) To study the vibrational and rotational relaxation of hot plasma ions; and (4) To investigate the ion-molecule reactions of vibrationally excited ions.

SUPPORTED BY U.S. National Science Foundation,
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of Atmospheric Sciences

10.0024, MILLIMETER SPECTROSCOPY OF INTERSTELLAR MOLECULES

P.A. VandenBout, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST77-28475 A01)

The spectral lines emitted by interstellar molecules at radio wavelengths will be studied. The main instrument used will be the 4.9 meter millimeter-wave antenna of The University of Texas at Austin. Observations will be made with other radio telescopes and with infrared telescopes when necessary. The observed spectral lines are analyzed to infer the physical conditions in the interstellar molecular clouds. Knowledge of these physical conditions is essential to an understanding of the star formation process taking place in these clouds. A variety of interstellar clouds from very simple ones where star formation has

not begun to progressively more complex ones will be observed. The association of star-forming clouds with supernova remnants will also be studied. The spectral lines of certain molecules will be observed throughout ranges of galactic latitude and longitude to infer the distribution of molecular material throughout the Galaxy and the role played by the spiral density wave in forming stars. The association of molecular material with astronomical objects of known or suspected youth will also be investigated. A program of observations of interstellar molecules in external galaxies will be begun. Several astrochemical studies will be attempted: searching for new interstellar molecules and new lines of known interstellar molecules; and studying certain deuterated molecules in a variety of clouds to define chemical production mechanisms and the degree to which fractionation of deuterium into these molecules has occurred.

This is a continuation of grant AST-7728475.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0025. INVESTIGATION OF LOW INTENSITY EMISSION LINES FROM THE INTERSTELLAR MEDIUM

F.L. Roesler, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Physics, *Agriculture Hall, Madison, Wisconsin* 53706 (AST79-08416)

The development of the 15-cm Fabry-Perot spectrometer and associated observing facility at the University of Wisconsin, Madison, has enabled us to carry out an intensive program of observations of extremely faint optical emission lines from the interstellar gas. The observations have provided important information about the distribution, temperature, ionization state, electron density, and filling factor for a widely distributed, ionized component of the interstellar medium as well as for more localized regions of ionization. The observations and data analysis will continue in more detail to study the diffuse emitting regions, including also faint filamentary structures which we have recently discovered. Furthermore, the spectral scope of our work will be extended into the infrared, where the Fabry-Perot spectrometer shows considerable promise for high resolution studies of infrared emission lines such as the quadrupole lines of H2 and the Brackett line of atomic hydrogen.

This is a continuation of AST-7707840AO1.

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N80-15027* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING. A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 115
Nov. 1979 92 p
(NASA-SP-7037(115)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 273 reports, articles, and other documents introduced into the NASA scientific and technical information system in October 1979. Author

N80-15028*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
LANDING APPROACH AIRFRAME NOISE MEASUREMENTS AND ANALYSIS
Paul L. Lasagna, Karen G. Mackall, Frank W. Burcham, Jr., and Terrill W. Putnam Jan. 1980 36 p refs
(NASA-TP-1602) Avail: NTIS HC A03/MF A01 CSCL 20A

Flyover measurements of the airframe noise produced by the AeroCommander, JetStar, CV-990, and B-747 airplanes are presented for various landing approach configurations. Empirical and semiempirical techniques are presented to correlate the measured airframe noise with airplane design and aerodynamic parameters. Airframe noise for the jet-powered airplanes in the clean configuration (flaps and gear retracted) was found to be adequately represented by a function of airplane weight and the fifth power of airspeed. Results show the airframe noise for all four aircraft in the landing configuration (flaps extended and gear down) also varied with the fifth power of airspeed, but this noise level could not be represented by the addition of a constant to the equation for clean-configuration airframe noise. M.G.

N80-15029# Boeing Aerospace Co., Seattle, Wash.
FLEET HARDNESS VARIATION Final Report, Jan. - Sep. 1978
E. N. York and S. L. Strack 29 Sep. 1978 45 p refs
(Contract DNA001-78-C-0138)
(AD-A074849; AD-E300588) Avail: NTIS HC A03/MF A01 CSCL 01/3

The variation of nuclear hardness in a fleet of aircraft is considered and the potential hardness degradation mechanisms identified. These include cracks, corrosion, paint deterioration, and aging of equipment. Methods are developed whereby the variation in hardness in a fleet could be estimated for each of these degradation mechanisms. GRA

N80-15030# Technology, Inc., Dayton, Ohio. Instruments and Controls Div.
APPLICATION OF THE SIRS CONCEPT TO NAVY HELICOPTERS
1 Oct. 1979 112 p refs
(Contract N00019-77-C-0318)
(AD-A074801; TI-0798-05-02) Avail: NTIS HC A06/MF A01 CSCL 01/3

In an effort to determine the feasibility of applying the U.S. Army-developed SIRS recording system to U.S. Navy helicopters, a study was conducted into the specific application of SIRS on the RH-53D helicopter. A fatigue damage assessment model was formulated for nine fatigue-critical dynamic components of the RH-53D helicopter, and two possible flight condition monitoring systems were synthesized. Both systems were found to be technically acceptable, but only one was practical based on current recording technology. The resulting system was analyzed from a life-cycle cost viewpoint and found to be cost-effective. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-15031*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTER PROGRAM TO PREPARE AIRFOIL CHARACTERISTIC DATA FOR USE IN HELICOPTER PERFORMANCE CALCULATIONS
Henry E. Jones Dec. 1977 57 p
(DA Proj. 1L1-61102-AH-45)
(NASA-TM-78627; L-11608) Avail: NTIS HC A04/MF A01 CSCL 01A

A computer program developed to prepare wind tunnel generated airfoil data for input into helicopter performance prediction programs is described. The program provides for numerically cross plotting the data, plotting the data, and tabulating and punching the tabulated result into computer cards for use in the rotorcraft flight simulation model. A.W.H.

N80-15032# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
STUDIES OF NON-LINEAR AERODYNAMIC CHARACTERISTICS OF FINNED SLENDER BODIES AT HIGH ANGLES OF ATTACK
J. Rom and D. Almosnino Nov. 1978 81 p refs
(TAE-349) Avail: NTIS HC A05/MF A01

A method is described for the computations of longitudinal aerodynamic characteristics of complex wing configurations at high angles of attack, and in subsonic flow, including nonlinear vortex lift caused by leading edge or side edge separations. The effects of jets injected near the nose of a body, on the side forces and yawing moments appearing at high angles of attack at subsonic and transonic speeds is presented. It was concluded that a great reduction of side force and yawing moment can be achieved using small amounts of air injection by this method. Further study is needed especially within the high subsonic and the transonic regions. M.M.M.

N80-15033*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CLASSICAL AERODYNAMIC THEORY
R. T. Jones, comp. Dec. 1979 308 p refs
(NASA-RP-1050; A-7556) Avail: NTIS HC A14/MF A01 CSCL 01A

A collection of papers on modern theoretical aerodynamics is presented. Included are theories of incompressible potential flow and research on the aerodynamic forces on wing and wing sections of aircraft and on airship hulls. For individual titles, see N80-15034 through N80-15047.

N80-15034*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
APPLICATIONS OF MODERN HYDRODYNAMICS TO AERONAUTICS. PART 1: FUNDAMENTAL CONCEPTS AND THE MOST IMPORTANT THEOREMS. PART 2: APPLICATIONS
L. Prandtl *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 1-56 refs Transl. into ENGLISH of unidentified German document (For primary document see N80-15033 06-02)
(NACA-116) Avail: NTIS HC A14/MF A01 CSCL 01A

A discussion of the principles of hydrodynamics of nonviscous fluids in the case of motion of solid bodies in a fluid is presented. Formulae are derived to demonstrate the transition from the fluid surface to a corresponding 'control surface'. The external forces are compounded of the fluid pressures on the control surface and the forces which are exercised on the fluid by any solid bodies which may be inside of the control surfaces. Illustrations of these formulae as applied to the acquisition of transformations from a known simple flow to new types of flow for other boundaries are given. Theoretical and experimental investigations of models of airship bodies are presented. M.M.M.

N80-15035*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
THE MECHANISM OF FLUID RESISTANCE
Th. vonKarman and H. Rubach *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 57-66 refs Transl. into ENGLISH from Phys. Z. (East Germany), 15 Jan. 1912 8 p (For primary document see N80-15033 06-02)
Avail: NTIS HC A14/MF A01 CSCL 01A

The mechanism of fluid resistance within the limit of the square law is presented. It was concluded that the investigations should be extended and completed in two directions, namely: by an investigation of stable vortex configurations in space, and by considering the perfect fluid as the limiting case of a viscous fluid and then limiting the law of vortex of formation with the condition that only those fluid particles which were in contact with the surface of the body can receive rotation. M.M.M.

N80-15036*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
PRESSURE DISTRIBUTION ON JOUKOWSKI WINGS
Otto Blumenthal *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 67-83 ref Transl. into ENGLISH from Z. fuer Flugtech. und Motorluftschiffahrt (Germany), 31 May 1913 16 p (For primary document see N80-15033 06-02)
(NACA-TM-336) Avail: NTIS HC A14/MF A01 CSCL 01A

The hydrodynamics and mathematical models as applied to the potential flow about a Joukowski wing are presented. M.M.M.

N80-15037*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
GRAPHIC CONSTRUCTION OF JOUKOWSKI WINGS
E. Trefftz *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 84-93 Transl. into ENGLISH from Z. fuer Flugtech. und Motorluftschiffahrt (Germany), 31 May 1913 p 130-131 (For primary document see N80-15033 06-02)
(NACA-TM-336) Avail: NTIS HC A14/MF A01 CSCL 01A

A plot of the cross sectional outline of a Joukowski wing is presented. M.M.M.

N80-15038*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
THE MINIMUM INDUCED DRAG OF AEROFOILS
Max M. Munk *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 95-110 (For primary document see N80-15033 06-02)
(NACA-121) Avail: NTIS HC A14/MF A01 CSCL 01A

Equations are derived to demonstrate which distribution of lifting elements result in a minimum amount of aerodynamic drag. The lifting elements were arranged (1) in one line, (2) parallel lying in a transverse plane, and (3) in any direction in a transverse plane. It was shown that the distribution of lift which causes the least drag is reduced to the solution of the problem for systems of airfoils which are situated in a plane perpendicular to the direction of flight. M.M.M.

N80-15039*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
THE AERODYNAMIC FORCES ON AIRSHIP HULLS
Max M. Munk *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 111-126 refs (For primary document see N80-15033 06-02)
(NACA-184) Avail: NTIS HC A14/MF A01 CSCL 01A

The new method for making computations in connection with the study of rigid airships, which was used in the investigation of Navy's ZR-1 by the special subcommittee of the National Advisory Committee for Aeronautics appointed for this purpose is presented. The general theory of the air forces on airship hulls of the type mentioned is described and an attempt was made to develop the results from the very fundamentals of mechanics. M.M.M.

N80-15040*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
ELEMENTS OF THE WING SECTION THEORY AND OF THE WING THEORY
Max M. Munk *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 127-149 refs (For primary document see N80-15033 06-02)
(NACA-191) Avail: NTIS HC A14/MF A01 CSCL 01A

Results are presented of the theory of wings and of wing sections which are of immediate practical value. They are proven and demonstrated by the use of the simple conceptions of kinetic energy and momentum only. M.M.M.

N80-15041*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
REMARKS ON THE PRESSURE DISTRIBUTION OVER THE SURFACE OF AN ELLIPSOID, MOVING TRANSLATIONALLY THROUGH A PERFECT FLUID
Max M. Munk *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 151-160 refs (For primary document see N80-15033 06-02)
(NACA-TM-196) Avail: NTIS HC A14/MF A01 CSCL 01A

The pressure distribution over ellipsoids when in translatory motion through a perfect fluid is calculated. A method to determine the magnitude of the velocity and of the pressure at each point of the surface of an ellipsoid of rotation is described. A.W.H.

N80-15042*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
THE INERTIA COEFFICIENTS OF AN AIRSHIP IN A FRICTIONLESS FLUID
H. Bateman *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 161-174 refs (For primary document see N80-15033 06-02)
(NACA-164) Avail: NTIS HC A14/MF A01 CSCL 01A

The apparent inertia of an airship hull is examined. The exact solution of the aerodynamical problem is studied for hulls of various shapes with special attention given to the case of an ellipsoidal hull. So that the results for the ellipsoidal hull may be readily adapted to other cases, they are expressed in terms of the area and perimeter of the largest cross section perpendicular to the direction of motion by means of a formula involving a coefficient kappa which varies only slowly when the shape of the hull is changed, being 0.637 for a circular or elliptic disk, 0.5 for a sphere, and about 0.25 for a spheroid of fineness ratio. The case of rotation of an airship hull is investigated and a coefficient is defined with the same advantages as the corresponding coefficient for rectilinear motion. A.W.H.

N80-15043*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
FLOW AND DRAG FORMULAS FOR SIMPLE QUADRICS
A. F. Zahm *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 175-196 refs (For primary document see N80-15033 06-02)
(NACA-253) Avail: NTIS HC A14/MF A01 CSCL 01A

The pressure distribution and resistance found by theory and experiment for simple quadrics fixed in an infinite uniform stream of practically incompressible fluid are calculated. The experimental values pertain to air and some liquids, especially water; the theoretical refer sometimes to perfect, again to viscid fluids. Formulas for the velocity at all points of the flow field are given. Pressure and pressure drag are discussed for a sphere, a round cylinder, the elliptic cylinder, the prolate and oblate spheroid, and the circular disk. The velocity and pressure in an oblique flow are examined. A.W.H.

N80-15044*# Naval Ship Research and Development Center, Washington, D. C.
FLOW AND FORCE EQUATIONS FOR A BODY REVOLVING IN A FLUID
A. F. Zahm *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 197-235 refs (For primary document see N80-15033 06-02)
(NACA-323) Avail: NTIS HC A14/MF A01 CSCL 01A

A general method for finding the steady flow velocity relative to a body in plane curvilinear motion, whence the pressure is found by Bernoulli's energy principle is described. Integration of the pressure supplies basic formulas for the zonal forces and moments on the revolving body. The application of the steady flow method for calculating the velocity and pressure at all points of the flow inside and outside an ellipsoid and some of its limiting forms is presented and graphs those quantities for the latter forms. In some useful cases experimental pressures are plotted for comparison with theoretical. The pressure, and thence the zonal force and moment, on hulls in plane curvilinear flight are calculated. General equations for the resultant fluid forces and moments on trisymmetrical bodies moving through a perfect fluid are derived. Formulas for potential coefficients and inertia coefficients for an ellipsoid and its limiting forms are presented. A.W.H.

N80-15045*# National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
BEHAVIOR OF VORTEX SYSTEMS
A. Betz *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 237-255 refs (For primary document see N80-15033 06-02)
Avail: NTIS HC A14/MF A01 CSCL 01A

Application of the Kutta-Joukowski theorem to the relationship between airfoil lift and circulation is described. A number of formulas concerning the conduct of vortex systems derived from the theorem are presented. The application of this line of reasoning to several problems of airfoil theory and the observed relations are discussed. A.W.H.

N80-15046*# National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.
GENERAL POTENTIAL THEORY OF ARBITRARY WING SECTIONS
Theodore Theodorsen and I. E. Garrick *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 257-289 refs (For primary document see N80-15033 06-02)
(NACA-452) Avail: NTIS HC A14/MF A01 CSCL 01A

The problem of determining the two dimensional potential flow around wing sections of any shape is examined. The problem is condensed into the compact form of an integral equation capable of yielding numerical solutions by a direct process. An attempt is made to analyze and coordinate the results of earlier studies relating to properties of wing sections. The existing approximate theory of thin wing sections and the Joukowski theory with its numerous generalizations are reduced to special cases of the general theory of arbitrary sections, permitting a clearer perspective of the entire field. The method which permits the determination of the velocity at any point of an arbitrary section and the associated lift and moments is described. The method is also discussed in terms for developing new shapes of preassigned aerodynamical properties. A.W.H.

N80-15047*# National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.
GENERAL THEORY OF AERODYNAMIC INSTABILITY AND THE MECHANISM OF FLUTTER
Theodore Theodorsen *In* NASA. Ames Res. Center Classical Aerodyn. Theory Dec. 1979 p 291-311 (For primary document see N80-15033 06-02)
(NACA-496) Avail: NTIS HC A14/MF A01 CSCL 01A

The aerodynamic forces on an oscillating airfoil or airfoil-aileron combination of three independent degrees of freedom were determined. The problem resolves itself into the solution of certain definite integrals, which were identified as Bessel functions of the first and second kind, and of zero and first order. The theory, based on potential flow and the Kutta condition, is fundamentally equivalent to the conventional wing section theory relating to the steady case. The air forces being known, the mechanism of aerodynamic instability was analyzed. An exact solution, involving potential flow and the adoption of the Kutta condition, was derived. The solution is of a simple form and is expressed by means of an auxiliary parameter k. The flutter velocity, treated as the unknown quantity, was determined as a function of a certain ratio of the frequencies in the separate degrees of freedom for any magnitudes and combinations of the airfoil-aileron parameters. A.W.H.

N80-15048*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
CALCULATION OF TWO-DIMENSIONAL INLET FLOW FIELDS IN A SUPERSONIC FREE STREAM BY AN IMPLICIT MARCHING CODE WITH NONORTHOGONAL MESH GENERATION: USER'S MANUAL Final Report
S. H. Beringen and O. J. McMillan Jan. 1980 27 p refs
(Contract NAS1-15305)
(NASA-CR-3222; NEAR-TR-193) Avail: NTIS HC A03/MF A01 CSCL 01A

An implicit, shock-capturing finite-difference code which is used to calculate two-dimensional inlet flow fields in a supersonic free stream is explained. The Euler equations are subjected to general nonorthogonal transformation and a body-fitted coordinate system is employed. The mathematical formulation of the problem is given along with the numerical algorithm. Initial and boundary conditions, numerical stability, program limitations, and accuracy is discussed. An overall program logic as well as instructions for program use and operation are also furnished. Author

N80-15049*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
A SUPERSONIC, THREE-DIMENSIONAL CODE FOR FLOW OVER BLUNT BODIES: USER'S MANUAL Final Report
D. S. Chaussee and O. J. McMillan Jan. 1980 27 p refs
(Contract NAS1-15305)
(NASA-CR-3223; NEAR-TR-189) Avail: NTIS HC A03/MF A01 CSCL 01A

A computer code is described which may be used to calculate the steady, supersonic, three-dimensional, inviscid flow over blunt bodies. The theoretical and numerical formulation of the problem is given (shock-capturing, downstream marching), including exposition of the boundary and initial conditions. The overall flow logic of the program, its usage, accuracy, and limitations are discussed. A.R.H.

N80-15050*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PARAMETRIC WING DESIGN STUDY FOR A MODERN LAMINAR FLOW WING
John A. Koegler, Jr. Dec. 1979 44 p refs
(NASA-TM-80154) Avail: NTIS HC A03/MF A01 CSCL 01A

The results of a parametric wing design study using a modern laminar flow airfoil designed to exhibit desirable stall characteristics while maintaining high cruise performance are presented. It was found that little is sacrificed in cruise performance when satisfying the stall margin requirements if a taper ratio of 0.65 or greater is used. M.G.

N80-15051*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF ADVANCED METHODS FOR PREDICTING HIGH SPEED PROPELLER PERFORMANCE
L. A. Bober 1980 14 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-81409) Avail: NTIS HC A02/MF A01 CSCL 01A

Three advanced analyses for predicting aircraft propeller performance at high subsonic speeds are described. Two of these analyses use a lifting line representation for the propeller blades and vortex filaments for the blade wakes but differ in the details of the solution. The third analysis is a finite difference solution of the unsteady, three dimensional Euler equations for the flow between adjacent blades. Analysis results are compared to data for a high speed propeller having eight swept blades integrally designed with the spinner and nacelle. Author

N80-15052*# Boeing Commercial Airplane Co., Seattle, Wash.
A USERS GUIDE FOR A344: A PROGRAM USING A FINITE DIFFERENCE METHOD TO ANALYZE TRANSONIC FLOW OVER OSCILLATING AIRFOILS Final Report
Warren H. Weatherill and F. Edward Ehlers Nov. 1979 65 p refs
(Contract NAS1-15128)
(NASA-CR-159141; D6-48837) Avail: NTIS HC A04/MF A01 CSCL 01A

The design and usage of a pilot program for calculating the pressure distributions over harmonically oscillating airfoils in transonic flow are described. The procedure used is based on separating the velocity potential into steady and unsteady parts and linearizing the resulting unsteady differential equations for small disturbances. The steady velocity potential which must be obtained from some other program, was required for input. The unsteady equation, as solved, is linear with spatially varying coefficients. Since sinusoidal motion was assumed, time was not a variable. The numerical solution was obtained through a finite difference formulation and either a line relaxation or an out of core direct solution method. R.C.T.

N80-15053# Naval Postgraduate School, Monterey, Calif.
A CONCEPTUAL DESIGN OF A LIGHTER-THAN-AIR TEST AND RESEARCH VEHICLE M.S. Thesis
Richard Patrick Glover Jun. 1979 69 p refs
(AD-A074760) Avail: NTIS HC A04/MF A01 CSCL 01/3

An analysis of conventional lighter-than-air vehicles was conducted to determine if a modular design approach was feasible. Once this was accomplished, a conceptual design using the modular approach was presented for a vehicle to serve as a platform for conducting lighter-than-air flight tests and research. In addition, a general discussion is included on the program management organization, flight tests, and instrumentation of such a vehicle. GRA

N80-15054# Martin Marietta Labs., Baltimore, Md.
SEPARATION JUMP AND SUDDEN STALL OVER AN ELLIPSOIDAL WING AT INCIDENCE
K. C. Wang May 1979 51 p refs
(Contract F49620-76-C-0004; AF Proj. 2304)
(AD-A074260; MML-TR-22C; AFOSR-79-0965TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

To obtain complete and rigorous solutions of the three-dimensional, laminar boundary layer over a finite airplane wing, a flat ellipsoid was chosen as a model to generate concrete results. Initial efforts were directed toward calculating the inviscid flow and the selection of coordinate system, and this was followed by a detailed investigation of the boundary layer restricted to the symmetry-plane. This investigation showed that as the incidence increases, the separation point on the upper surface does not always move continuously forward, instead, it first moves forward and later rearward. Then, at a critical incidence, it jumps forward and moves thereafter close to the leading edge. This 'separation jump' phenomenon was further found to be little affected by varying the span, but critically dependent on the chord: a longer chord prompts a larger jump. Although such separation jump has been reported for a body of revolution, it has not yet been reported for wing surfaces. The significance of this phenomenon is apparent when one considers that the separation jump may well occur on airplane wings in general and probably accounts for what we might call 'sudden stall'. GRA

N80-15055# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF THE AERODYNAMIC CHARACTERISTICS OF A 1/20-SCALE A-10 MODEL AT MACH NUMBERS FROM 0.30 TO 0.75 Final Report
Phillip L. Yeakley AEDC Sep. 1979 90 p refs
(AF Proj. 329A)
(AD-A074867; AEDC-TR-78-66; AFATL-TR-78-103) Avail: NTIS HC A05/MF A01 CSCL 20/4

A 1/20-scale model of the A-10 aircraft was tested to determine the aerodynamic and control characteristics of the basic aircraft, evaluate the effect of external store configurations on the static stability and drag characteristics of the aircraft, and investigate the effects of Reynolds number, boundary layer transition grit, and aerodynamic hysteresis on the data. Data were obtained at angles of attack from -4 to 20 deg and at sideslip angles from -10 to 10 deg. The Mach number range was from 0.30 to 0.75, and the Reynolds number range was from 0.7 to 4.9 million per foot. GRA

N80-15056# Aerospace Corp., Los Angeles, Calif.
AERODYNAMIC HEATING ON A MULTI-HUNDRED WATT HEAT SOURCE BASED ON WIND TUNNEL TESTS Final Report
Mamoru Masaki Kirtland AFB, N. Mex. AFWL Jul. 1979 21 p refs
(Contract F04701-77-C-0078; AF Proj. 2007)
(AD-A074312; AD-E200359; AFWL-TR-78-160) Avail: NTIS HC A02/MF A01 CSCL 20/4

The General Electric Space Division conducted aerodynamic heating tests of the multi-hundred watt heat source configuration of the NASA Mariner-Jupiter/Saturn spacecraft. Curve fit approximations of the data were obtained so that aerodynamic heating studies with any angle of attack history can be performed in a simple manner. Characteristics of theoretical and semi-empirical results for the type of configuration were utilized in obtaining the approximations due to some discrepancies in the data. GRA

N80-15057# Tennessee Univ. Space Inst., Tullahoma. Gasdynamics Div.
FUNDAMENTAL STUDIES OF SUBSONIC AND TRANSONIC FLOW SEPARATION. PART 3: THIRD PHASE SUMMARY REPORT Final Report, Nov. 1975 - Sep. 1978
J. M. Wu, A. Vakili-Dastjerd, E. G. Collins, K. C. Reddy, and T. H. Moulden Arnold Air Force Station, Tenn. AEDC Oct. 1979 157 p refs
(Contract F40600-76-C-0006)
(AD-A074868; AEDC-TR-79-48-Pt-3) Avail: NTIS HC A08/MF A01 CSCL 20/4

The work reported herein represents the third phase of a fundamental study of transonic flow separation with extensive experimental measurements and some numerical Navier-Stokes solutions for high Reynolds number two-dimensional flow. The flow conditions have been extended to include low supersonic free-stream cases. The tests were performed over a Mach number range of 0.6 and 1.32 and Reynolds number range of 4 to 200 million. Simple geometrical surface and flow discontinuities of different sizes (such as ramps, rearward and forward-facing steps, cylinders, etc.) were selected to cause upstream disturbances and/or generate downstream adverse pressure gradient regions strong enough to produce local flow separation. The incipient separation angle in flow over ramp compression corner was measured. An average incipient separation angle of 22.5 deg was confirmed, with no Reynolds number effect in the above range of free-stream flow parameters. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-15058*# Dayton Univ. Research Inst., Ohio.
A FIRST LOOK AT THE EFFECT OF SEVERE RAINFALL UPON AN AIRCRAFT
Jan. 1980 34 p refs
(Grant NsG-6026)
(NASA-CR-162569) Avail: NTIS HC A03/MF A01 CSCL 01C

An aircraft penetrating heavy rain can be affected aerodynamically in at least four ways: (1) raindrops striking the fuselage and wings of the aircraft impart a downward momentum to the aircraft; (2) increased aircraft drag results from the aircraft striking the raindrops head on; (3) at any instant of time the aircraft will contain a thin layer of water over most of its surfaces which will give additional mass to the aircraft; and (4) the water on the airfoil will result in a roughened airfoil surface that could produce significant aerodynamic penalties. An order of magnitude calculation was made for the penalty associated with the factors one two and three. The roughness factor required detailed modeling and boundary layer calculations and was studied using the 'aerodynamic effects of frost model'. The results achieved on each of the penalty factors are described and the factors most likely to cause significant performance degradation are indicated. R.E.S.

N80-15059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULTANEOUS CABIN AND AMBIENT OZONE MEASUREMENTS ON TWO BOEING 747 AIRPLANES, VOLUME 1
Porter J. Perkins, J. D. Holdeman, and G. D. Nastrom (Control Data Corp., Minneapolis, Minn.) Jul. 1979 826 p refs
(NASA-TM-79166; FAA-EE-79-05; E-196) Avail: NTIS HC A99/MF A01 CSCL 01C

Measurements of zone concentrations both outside and in the cabin of an airline operated Boeing 747SP and Boeing 747-100 airliner are presented. Plotted data and the corresponding tables of observations taken at altitude between the departure and destination airports of each flight are arranged chronologically for the two aircraft. Data were taken at five or ten minute intervals by automated instrumentation used in the NACA Global Atmospheric Sampling Program. M.M.M.

N80-15060*# National Aeronautics and Space Administration, Washington, D. C.
NASA TECHNICAL ADVANCES IN AIRCRAFT OCCUPANT SAFETY
John H. Enders 1978 28 p refs Presented at the SAE Congr. and Exposition, Detroit, 27 Feb. - 3 Mar. 1978
(NASA-TM-80851; ISSN-0148-7191) Avail: NTIS HC A03/MF A01 CSCL 01C

NASA's aviation safety technology program examines specific safety problems associated with atmospheric hazards, crash-fire survival, control of aircraft on runways, human factors, terminal area operations hazards, and accident factors simulation. While aircraft occupants are ultimately affected by any of these hazards, their well-being is immediately impacted by three specific events: unexpected turbulence encounters, fire and its effects, and crash impact. NASA research in the application of laser technology to the problem of clear air turbulence detection, the development of fire resistant materials for aircraft construction, and to the improvement of seats and restraint systems to reduce crash injuries are reviewed. A.R.H.

N80-15061# General Accounting Office, Washington, D. C. Community and Economic Development Div.
AIRCRAFT DELAYS AT MAJOR US AIRPORTS CAN BE REDUCED
4 Sep. 1979 36 p refs
(PB-299442/4; CED-79-102) Avail: NTIS HC A03/MF A01 CSCL 01E

In 1977, aircraft delays cost U.S. airlines over $800 million; detained the traveling public over 60 million hours; and caused the airlines to use an additional 700 million gallons of fuel, over 8 percent of their total consumption. Generally, aircraft delays result from excessive air traffic and bad weather. Many major U.S. airports have peak, congested periods when air traffic exceeds runway capacity and aircraft delays occur. To reduce delays at major airports, the Congress and Secretary of Transportation should take actions to shift traffic from peak to off-peak periods or to other airports by amending the Airport and Airway Development Act of 1970. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-15062*# Magnavox Government and Industrial Electronics Co., Torrance, Calif. Advanced Products Div.
DESIGN STUDY OF A LOW COST CIVIL AVIATION GPS RECEIVER SYSTEM Final Report
R. Cnossen and G. Gilbert (GAC Assoc.) Dec. 1979 150 p refs
(Contract NAS1-15343)
(NASA-CR-159176; R-6132) Avail: NTIS HC A07/MF A01 CSCL 17G

A low cost Navstar receiver system for civil aviation applications was defined. User objectives and constraints were established. Alternative navigation processing design trades were evaluated. Receiver hardware was synthesized by comparing technology projections with various candidate system designs. A control display unit design was recommended as the result of field test experience with Phase I GPS sets and a review of special human factors for general aviation users. Areas requiring technology development to ensure a low cost Navstar Set in the 1985 timeframe were identified. R.C.T.

N80-15063*# Ohio Univ., Athens. Avionics Engineering Center.
EXPERIMENTAL LOOP ANTENNAS FOR 60 KHz TO 200 KHz
Ralph W. Burhans Dec. 1979 9 p refs
(Grant NGR-36-009-017)
(NASA-CR-162729; TM-71) Avail: NTIS HC A02/MF A01 CSCL 17G

The design and design data for broadband loop antenna systems are presented. An investigation of some simple systems for possible Loran C receivers which require a bandwidth of greater than 20 KHz is discussed. Designs are presented for a 60 KHz WWVB antenna, several Loran C variations, and some 1750 meter band antennas. Signals received on all these, including one airborne experiment where a Loran C receiver gave the correct time difference reading within 1 microsecond while flying on a straightline course are examined. The phase reversal in the Loran C when the direction of travel changes 180 degrees is discussed and possible corrections are studied. A.W.H.

N80-15064*# Ohio Univ., Athens. Avionics Engineering Center.
DATA REDUCTION SOFTWARE FOR LORAN-C FLIGHT TEST EVALUATION
Joseph P. Fischer Dec. 1979 43 p refs
(Grant NGR-36-009-017)
(NASA-CR-162730; TM-72) Avail: NTIS HC A03/MF A01 CSCL 17G

A set of programs designed to be run on an IBM 370/158 computer to read the recorded time differences from the tape produced by the LORAN data collection system, convert

them to latitude/longitude and produce various plotting input files are described. The programs were written so they may be tailored easily to meet the demands of a particular data reduction job. The tape reader program is written in 370 assembler language and the remaining programs are written in standard IBM FORTRAN-IV language. The tape reader program is dependent upon the recording format used by the data collection system and on the I/O macros used at the computing facility. The other programs are generally device-independent, although the plotting routines are dependent upon the plotting method used. The data reduction programs convert the recorded data to a more readily usable form; convert the time difference (TD) numbers to latitude/longitude (lat/long), to format a printed listing of the TDs, lat/long, reference times, and other information derived from the data, and produce data files which may be used for subsequent plotting. M.M.M.

N80-15065*# Ohio Univ., Athens. Avionics Engineering Center.
LORAN DIGITAL PHASE-LOCKED LOOP AND RF FRONT-END SYSTEM ERROR ANALYSIS
Daryl L. McCall. Dec. 1979. 19 p.
(Grant NGR-39-009-017)
(NASA-CR-152731; TM-73) Avail: NTIS. HC A02/MF A01. CSCL 17G

An analysis of the system performance of the digital phase locked loops (DPLL) and RF front end that are implemented in the MINI-L4 Loran receiver is presented. Three of the four experiments deal with the performance of the digital phase locked loops. The other experiment deals with the RF front end and DPLL system error which arise in the front end due to poor signal to noise ratios. The ability of the DPLLs to track the offsets is studied.

N80-15066# Transportation Systems Center, Cambridge, Mass.
THE EFFECTS OF PRIMARY POWER TRANSMISSION LINES ON THE PERFORMANCE OF LORAN-C RECEIVERS IN EXPERIMENTAL TERRESTRIAL APPLICATIONS. Final Report, May - Jul. 1979
Peter G. Mauro and John D. Gakis. Jul. 1979. 171 p. refs.
Sponsored by DOT
(PB-301367/9; DOT-TSC-RSPA-79-8) Avail: NTIS. HC A08/MF A01. CSCL 17G

The effect generated by high voltage transmission lines with and without supervisory carrier signals on the performance of typical LORAN-C receivers was measured. Four high voltage transmission line configurations were used and tested with 60Hz power impressed and absent and carrier signals impressed and absent. Data are plotted for three secondary time differences measured using the East Coast LORAN-C chain. Signal to noise ratios for the secondaries as well as the master were measured and recorded. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes *aircraft simulation technology*.
For related information see *also 18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-15067*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA/ARMY XV-15 TILT ROTOR RESEARCH AIRCRAFT WIND-TUNNEL TEST PROGRAM PLAN
James A. Weiberg and Martin D. Maisel (AVRADCOM Res. and Technol. Labs.). Mar. 1979. 73 p. refs.
(NASA-TM-78562; A-7740; AVRADCOM-TR-79-7(AM)) Avail: NASA. Ames Research Center, Moffett Field, Calif. 94035. CSCL 01C

To ensure that the XV-15 tilt rotor research aircraft will meet the requirements of the program plan and the contract model specification and statement of work, one of the two aircraft will be tested in the Ames 40 x 80 foot wind tunnel to provide an initial assessment of the aerodynamic characteristics, structural loads, and rotor/pylon/wing dynamics in a simulated flight environment for correlation with estimated values. The tests will also serve to verify the functional operation of the aircraft systems and on-board instrumentation in a flight environment. The management structure, operational plan, support requirements and responsibilities, safety provisions and reporting requirements for conduct of the wind tunnel tests are defined and related to other phases of the program. A.R.H.

N80-15068*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
LOADING TESTS OF A WING STRUCTURE FOR A HYPERSONIC AIRCRAFT
Roger A. Fields, Lawrence F. Reardon, and William H. Siegel. Jan. 1980. 72 p. refs.
(NASA-TP-1596; H-1046) Avail: NTIS. HC A04/MF A01. CSCL 01C

Room-temperature loading tests were conducted on a wing structure designed with a beaded panel concept for a Mach 8 hypersonic research airplane. Strain, stress, and deflection data were compared with the results of three finite-element structural analysis computer programs and with design data. The test program data were used to evaluate the structural concept and the methods of analysis used in the design. A force stiffness technique was utilized in conjunction with load conditions which produced various combinations of panel shear and compression loading to determine the failure envelope of the buckling critical beaded panels. The force-stiffness data did not result in any predictions of buckling failure. It was, therefore, concluded that the panels were conservatively designed as a result of design constraints and assumptions of panel eccentricities. The analysis programs calculated strains and stresses competently. Comparisons between calculated and measured structural deflections showed good agreement. The test program offered a positive demonstration of the beaded panel concept subjected to room-temperature load conditions. Author

N80-15069*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECTS OF MOTION AND g-SEAT CUES ON PILOT SIMULATOR PERFORMANCE OF THREE PILOTING TASKS
Thomas W. Showalter and Benton L. Parris. Jan. 1980. 45 p. refs.
(NASA-TP-1601; A-7875) Avail: NTIS. HC A03/MF A01. CSCL 01C

Data are presented that show the effects of motion system cues, g-seat cues, and pilot experience on pilot performance during takeoffs with engine failures, during in-flight precision turns, and during landings with wind shear. Eight groups of USAF pilots flew a simulated KC-135 using four different cueing systems. The basic cueing system was a fixed-base type (no-motion cueing) with visual cueing. The other three systems were produced by the presence of either a motion system or a g-seat, or both. Extensive statistical analysis of the data was performed and representative performance means were examined. These data show that the addition of motion system cueing results in significant improvement in pilot performance for all three tasks; however, the use of g-seat cueing, either alone or in conjunction with the motion system, provides little if any performance improvement for these tasks and for this aircraft type. Author

N80-15070*# Lockheed-Georgia Co., Marietta.
EXPLORATORY STUDIES OF THE CRUISE PERFORMANCE OF UPPER SURFACE BLOWN CONFIGURATION: EXPERIMENTAL PROGRAM, HIGH-SPEED FORCE TESTS
J. A. Braden, J. P. Hancock, K. P. Burdges, and J. E. Hackett. Langley Res. Center, Hampton, Va. NASA. Oct. 1979. 231 p. refs.
(Contract NAS1-13871)
(NASA-CR-159134; LG77ER0028) Avail: NTIS. HC A11/MF A01. CSCL 01C

The work to develop a wing-nacelle arrangement to accommodate a wide range of upper surface blown configuration is reported. Pertinent model and installation details are described. Data of the effects of a wide range of nozzle geometric variations are presented. Nozzle aspect ratio, boattail angle, and chordwise

position are among the parameters investigated. Straight and swept wing configurations were tested across a range of nozzle pressure ratios, lift coefficients, and Mach numbers. F.O.S.

N80-15071*# Lockheed-Georgia Co., Marietta.
EXPLORATORY STUDIES OF THE CRUISE PERFORMANCE OF UPPER SURFACE BLOWN CONFIGURATIONS: EXPERIMENTAL PROGRAM, HIGH-SPEED PRESSURE TESTS
J. A. Braden, J. P. Hancock, K. P. Burdges, and J. E. Hackett Langley Res. Center, Hampton, Va. NASA Oct. 1979 226 p refs
(Contract NAS1-13871)
(NASA-CR-159135; LG77ER0028) Avail: NTIS HC A11/MF A01 CSCL 01C

Basic pressure data are presented which was obtained from an experimental study of upper-surface blown configurations at cruise. The high-speed (subsonic) experimental work, studying the aerodynamic effects of wing-nacelle geometric variations, was conducted around semi-span model configurations composed of diversified, interchangeable components. Power simulation was provided by high-pressure air ducted through closed forebody nacelles. Nozzle geometry was varied across size, exit aspect ratio, exit position and boattail angle. Both 3-D force and 2-D pressure measurements were obtained at cruise Mach numbers from 0.5 to 0.8 and at nozzle pressure ratios up to about 3.0. The experimental investigation was supported by an analytical synthesis of the system using a vortex lattice representation with first-order power effects. Results are also presented from a compatibility study in which a short-haul transport is designed on the basis of the aerodynamic findings in the experimental study as well as acoustical data obtained in a concurrent program. High-lift test data are used to substantiate the projected performance of the selected transport design. Author

N80-15072*# Lockheed-Georgia Co., Marietta.
EXPLORATORY STUDIES OF THE CRUISE PERFORMANCE OF UPPER SURFACE BLOWN CONFIGURATIONS: PROGRAM ANALYSIS AND CONCLUSIONS
J. A. Braden, J. P. Hancock, J. E. Hackett, and V. Lyman Langley Res. Center, Hampton, Va. NASA Oct. 1979 349 p refs
(Contract NAS1-13871)
(NASA-CR-159136; LG77ER0028) Avail: NTIS HC A15/MF A01 CSCL 01C

The experimental data encompassing surface pressure measurements, and wake surveys at static and wind-on conditions are analyzed. Cruise performance trends reflecting nacelle geometric variations, and nozzle operating conditions are presented. Details of the modeling process are included. F.O.S.

N80-15073*# Rockwell International Corp., El Segundo, Calif.
ANALYSES AND TESTS OF THE B-1 AIRCRAFT STRUCTURAL MODE CONTROL SYSTEM Final Report
John H. Wykes, Thomas R. Byar, Cary J. MacMiller, and David C. Greek Jan. 1980 268 p refs
(Contract NAS4-2519)
(NASA-CR-144887; H-1109; NA-79-405) Avail: NTIS HC A12/MF A01 CSCL 01C

Analyses and flight tests of the B-1 structural mode control system (SMCS) are presented. Improvements in the total dynamic response of a flexible aircraft and the benefits to ride qualities, handling qualities, crew efficiency, and reduced dynamic loads on the primary structures, were investigated. The effectiveness and the performance of the SMCS, which uses small aerodynamic surfaces at the vehicle nose to provide damping to the structural modes, were evaluated. R.E.S.

N80-15074*# Lockheed-California Co., Burbank.
HYPERSONIC CRUISE AIRCRAFT PROPULSION INTEGRATION STUDY, VOLUME 1 Final Report, Jun. 1978 - Sep. 1979
R. E. Morris and G. D. Brewer Sep. 1979 96 p ref
(Contract NAS1-15057)
(NASA-CR-158926-Vol-1; LR-28651-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 01C

A hypersonic cruise transport conceptual design is described. The integration of the subsonic, supersonic, and hypersonic propulsion systems with the aerodynamic design of the airframe is emphasized. An evaluation of various configurations of aircraft and propulsion integration concepts, and selection and refinement of a final design are given. This configuration was used as a baseline to compare two propulsion concepts - one using a fixed geometry dual combustion mode scramjet and the other a variable geometry ramjet engine. Both concepts used turbojet engines for takeoff, landing and accelaration to supersonic speed. R.C.T.

N80-15075*# Lockheed-California Co., Burbank.
HYPERSONIC CRUISE AIRCRAFT PROPULSION INTEGRATION STUDY, VOLUME 2 Final Report, Jun. 1978 - Sep. 1979
R. E. Morris and G. D. Brewrr Sep. 1979 244 p refs
(Contract NAS1-15057)
(NASA-CR-158926-Vol-2; LR-28651-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 01C

Conceptual vehicle configuration and propulsion approach for a Mach 6 transport aircraft capable of carring 200 passengers 9260 km was investigated. Wind tunnel test data for various hypersonic transport configurations were examined. Canidates for baseline reference vehicles were selected. An explanation of technical methods which were used and configuration details which were significant in the final vehicle concept are given. R.C.T.

N80-15076*# Rensselaer Polytechnic Inst., Troy, N. Y.
COMPOSITE STRUCTURAL MATERIALS Semiannual Report, Apr. - Sep. 1979
George S. Ansell, Robert G. Loewy, and Stephen E. Wiberly Dec. 1979 107 p refs Sponsored in part by AFOSR
(Grant NGL-33-018-003)
(NASA-CR-162578; SAR-37) Avail: NTIS HC A06/MF A01 CSCL 01C

A multifaceted program is described in which aeronautical, mechanical, and materials engineers interact to develop composite aircraft structures. Topics covered include: (1) the design of an advanced composite elevator and a proposed spar and rib assembly; (2) optimizing fiber orientation in the vicinity of heavily loaded joints; (3) failure mechanisms and delamination; (4) the construction of an ultralight sailplane; (5) computer-aided design; finite element analysis programs, preprocessor development, and array preprocessor for SPAR; (6) advanced analysis methods for composite structures; (7) ultrasonic nondestructive testing; (8) physical properties of epoxy resins and composites; (9) fatigue in composite materials, and (10) transverse thermal expansion of carbon/epoxy composites. A.R.H.

N80-15077# Boeing Vertol Co., Philadelphia, Pa.
CH-46 COMPOSITE ROTOR BLADE FLIGHT STRESS SURVEY DATA. VOLUME 3: PLOTTED FORWARD ROTOR BLADE CHORD, TORSION AND ABSOLUTE LOADS
R. Aiello and J. Bendo 1978 324 p refs
(Contract N00019-75-C-0396)
(AD-A075612; D210-11168-3-Vol-3) Avail: NTIS HC A14/MF A01 CSCL 01/3

Data plots are presented of flight stress tests performed on the CH-46 aircraft composite rotor blades. M.M.M.

N80-15078# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRCRAFT ANTI-ICING/DE-ICING Final Report
31 Aug. 1979 21 p
(AD-A074128; TOP-7-3-528) Avail: NTIS HC A02/MF A01 CSCL 01/3

This document provides information, methodology and techniques necessary to plan, conduct and document a development test of an aircraft anti-icing/de-icing system. A development test of an aircraft anti-icing/de-icing system will determine the degree to which a subject system and its associated documentation, tools and auxiliary equipment meets the requirements of the Army Materiel Needs documents. GRA

N80-15079# Textron Bell Helicopter, Fort Worth, Tex.
ANALYSIS OF LOW-SPEED HELICOPTER FLIGHT TEST DATA Final Report, Mar. 1977 - Mar. 1979
James L. Tangler Aug. 1979 145 p refs
(Contract DAAJ02-77-C-0022; DA Proj. 1L2-62209-AH-76)

(AD-A074141; BHT-699-099-103; USARTL-TR-79-19) Avail: NTIS HC A07/MF A01 CSCL 01/3

The purpose of this study was to investigate the aerodynamic behavior of a helicopter rotor operating in the low-speed flight regime, particularly in the nap-of-the-Earth (NOE) evasive mode. The effort consisted of reducing and analyzing existing AH-1G flight test response data acquired for simulated NOE flight under contract DAAJ02-73-C-0105. Specific areas of interest analyzed in this study include blade/vortex interaction at 50 knots and angle-of-attack data derived from hot-wire measurements taken in hover. GRA

N80-15080# Naval Air Test Center, Patuxent River, Md.
JA-6A CIRCULATION CONTROL WING CONTRACTOR FLIGHT DEMONSTRATION
R. W. Boyd 28 Aug. 1979 25 p refs
(AD-A074888; NATC-TM-79-2-SA) Avail: NTIS HC A02/MF A01 CSCL 01/3

A Circulation Control Wing (CCW) Flight Demonstrator was designed and built by Grumman Aerospace Corporation (GAC) using a modified A-6A airplane. The design was a joint effort by David Taylor Naval Ship Research and Development Center (DTNSRDC) and GAC based on research originated by DTNSRDC. The airplane demonstrated significant STOL potential. Compared to the basic A-6A airplane, takeoff and landing roll distances were improved by 36% and 43%, respectively. Maximum CL was increased by 80%. Some Handling Qualities problems are discussed. The CCW concept was shown to be a viable, simple, and powerful STOL tool for use in future designs. GRA

N80-15081# Army Research and Technology Labs., Fort Eustis, Va.
MODEL 540 ROTOR BLADE CRACK PROPAGATION INVESTIGATION Final Report, Jan. - Feb. 1978
Danny E. Good Aug. 1979 35 p refs
(DA Proj. 1F2-62209-AH-76)
(AD-A074734; USARTL-TR-79-26) Avail: NTIS HC A03/MF A01 CSCL 01/3

The rate of crack propagation from an induced defect in a metal Bell Helicopter 540 main rotor blade was investigated. A controlled crack front was introduced into the top surface of the blade spar. Fatigue testing was conducted at maximum level flight loads and the crack growth was monitored. Experimental data was then compared with analytical predictions to measure the ability to predict crack growth characteristics. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-15082# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
VISUAL ACCOMMODATION RESPONSES IN A VIRTUAL IMAGE ENVIRONMENT Phase Report
Gloria Twine Chisum and Phyllis E. Morway 1979 15 p refs (WR041010101)
(AD-A074415; NADC-79213-60) Avail: NTIS HC A02/MF A01 CSCL 05/5

The virtual images generated for helmet mounted displays and head-up displays are reflected by beam splitters to the eyes of a user. The influence of the beam splitters, with and without images reflected, on the accommodation responses of observers was measured utilizing an eyetracker which continuosly monitored the accommodation response. The results indicate that the presence of the beam splitter aids in maintaining accommodation at or near infinity. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-15083*# General Electric Co., Washington, D. C. Aircraft Engine Group.
DEMONSTRATION OF SHORT-HAUL AIRCRAFT AFT NOISE REDUCTION TECHNIQUES ON A TWENTY INCH (50.8 cm) DIAMETER FAN, VOLUME 1
D. L. Stimpert and R. A. McFalls May 1975 131 p refs 3 Vol.
(Contract NAS3-18021)
(NASA-CR-134849; R75AEG252-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 21E

Tests of a 20 inch diameter, low tip speed, low pressure ratio fan which investigated aft fan noise reduction techniques are reported. These techniques included source noise reduction features of selection of vane-blade ratio to reduce second harmonic noise, spacing effects, and lowering the Mach number through a vane row. Aft suppression features investigated included porosity effects, variable depth treatment, and treatment regenerated flow noise. Initial results and selected comparisons are presented. J.M.S.

N80-15084*# General Electric Co., Washington, D. C. Aircraft Engine Group.
DEMONSTRATION OF SHORT-HAUL AIRCRAFT AFT NOISE REDUCTION TECHNIQUES ON A TWENTY INCH (50.8) DIAMETER FAN, VOLUME 2
D. L. Stimpert Apr. 1975 307 p 3 Vol.
(Contract NAS3-18021)
(NASA-CR-134850; R75AEG252-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 21E

Aft fan noise reduction techniques were investigated. The 1/3 octave band sound data were plotted with the following plots included: perceived noise level vs acoustic angle at 2 fan speeds; PWL vs frequency at 2 fan speeds; and sound pressure level vs frequency at 2 aft angles and 2 fan speeds. The source noise plots included: band pass filter sound pressure level vs acoustic angle at 2 fan speeds; and 2nd harmonic SPL acoustic angle at 2 fan speeds. R.C.T.

N80-15085*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
DEMONSTRATION OF SHORT HAUL AIRCRAFT AFT NOISE REDUCTION TECHNIQUES ON A TWENTY INCH (50.8 cm) DIAMETER FAN, VOLUME 3
D. L. Stimpert Apr. 1975 725 p 3 Vol.
(Contract NAS3-18021)
(NASA-CR-134851; R75AEG252-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 21E

Tests of a twenty inch diameter, low tip speed, low pressure ratio fan which investigated aft fan noise reduction techniques are reported. The 1/3 octave band sound data are presented for all the configurations tested. The model data are presented on 17 foot arc and extrapolated to 200 foot sideline. J.M.S.

N80-15086*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER THE WING (OTW) DESIGN REPORT Final Report
Jun. 1977 530 p
(Contract NAS3-18021)
(NASA-CR-134848; R75AEG443) Avail: NTIS HC A23/MF A01 CSCL 21E

The design, fabrication, and testing of two experimental high bypass geared turbofan engines and propulsion systems for short haul passenger aircraft are described. The propulsion technology required for future externally blown flap aircraft with engines located both under the wing and over the wing is demonstrated.

Composite structures and digital engine controls are among the topics included. R.C.T.

N80-15087*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). AERODYNAMIC AND AEROMECHANICAL PERFORMANCE OF A 50.8 cm (20 INCH) DIAMETER 1.34 PR VARIABLE PITCH FAN WITH CORE FLOW
R. G. Giffin, R. A. McFalls, and B. F. Beacher Aug. 1977 133 p refs
(Contract NAS3-18021)
(NASA-CR-135017; R75AEG445) Avail: NTIS HC A07/MF A01 CSCL 21E

The fan aerodynamic and aeromechanical performance tests of the quiet clean short haul experimental engine under the wing fan and inlet with a simulated core flow are described. Overall forward mode fan performance is presented at each rotor pitch angle setting with conventional flow pressure ratio efficiency fan maps, distinguishing the performance characteristics of the fan bypass and fan core regions. Effects of off design bypass ratio, hybrid inlet geometry, and tip radial inlet distortion on fan performance are determined. The nonaxisymmetric bypass OGV and pylon configuration is assessed relative to both total pressure loss and induced circumferential flow distortion. Reverse mode performance, obtained by resetting the rotor blades through both the stall pitch and flat pitch directions, is discussed in terms of the conventional flow pressure ratio relationship and its implications upon achievable reverse thrust. Core performance in reverse mode operation is presented in terms of overall recovery levels and radial profiles existing at the simulated core inlet plane. Observations of the starting phenomena associated with the initiation of stable rotor flow during acceleration in the reverse mode are briefly discussed. Aeromechanical response characteristics of the fan blades are presented as a separate appendix, along with a description of the vehicle instrumentation and method of data reduction. R.C.T.

N80-15088*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) PRELIMINARY UNDER THE WING FLIGHT PROPULSION SYSTEM ANALYSIS REPORT
D. F. Howard Feb. 1976 261 p refs
(Contract NAS3-18021)
(NASA-CR-134868; R75AEG349) Avail: NTIS HC A12/MF A01 CSCL 21E

The preliminary design and installation of high bypass, geared turbofan engine with a composite nacelle forming the propulsion system for a short haul passenger aircraft are described. The technology required for externally blown flap aircraft with under the wing (UTW) propulsion system installations for introduction into passenger service in the mid 1980's is included. The design, fabrication, and testing of this UTW experimental engine containing the required technology items for low noise, fuel economy, with composite structure for reduced weight and digital engine control are provided. R.C.T.

N80-15089*# General Electric Co., Cincinnati, Ohio. Group Engineering Div.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). THE AERODYNAMIC AND MECHANICAL DESIGN OF THE QCSEE OVER-THE-WING FAN
Apr. 1976 98 p
(Contract NAS3-18021)
(NASA-CR-134915) Avail: NTIS HC A05/MF A01 CSCL 21E

The aerodynamic and mechanical design of a fixed-pitch 1.36 pressure ratio fan for the over-the-wing (OTW) engine is presented. The fan has 28 blades. Aerodynamically, the fan blades were designed for a composite blade, but titanium blades were used in the experimental fan as a cost savings measure. R.E.S.

N80-15090*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING ENGINE DIGITAL CONTROL SYSTEM DESIGN REPORT
Jan. 1978 321 p refs
(Contract NAS3-18021)
(NASA-CR-134920; R75AEG483) Avail: NTIS HC A14/MF A01 CSCL 21E

A digital electronic control was combined with conventional hydromechanical components to operate the four controlled variables on the under-the-wing engine: fuel flow, fan blade pitch, fan exhaust area, and core compressor stator angles. The engine and control combination offers improvements in noise, pollution, thrust response, operational monitoring, and pilot workload relative to current engines. R.E.S.

N80-15091*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING ENGINE SIMULATION REPORT
Jul. 1977 103 p refs
(Contract NAS3-18021)
(NASA-CR-134914; R75AEG444) Avail: NTIS HC A06/MF A01 CSCL 21E

Hybrid computer simulations of the under-the-wing engine were constructed to develop the dynamic design of the controls. The engine and control system includes a variable pitch fan and a digital electronic control. Simulation results for throttle bursts from 62 to 100 percent net thrust predict that the engine will accelerate 62 to 95 percent net thrust in one second. R.E.S.

N80-15092*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING CONTROL SYSTEM DESIGN REPORT
Dec. 1977 249 p refs
(Contract NAS3-18021)
(NASA-CR-135337; R77AEG664) Avail: NTIS HC A11/MF A01 CSCL 21E

A control system incorporating a digital electronic control was designed for the over-the-wing engine. The digital electronic control serves as the primary controlling element for engine fuel flow and core compressor stator position. It also includes data monitoring capability, a unique failure indication and corrective action feature, and optional provisions for operating with a new type of servovalve designed to operate in response to a digital-type signal and to fail with its output device hydraulically locked into position. R.E.S.

N80-15093*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). CORE ENGINE NOISE MEASUREMENTS
H. D. Sowers and W. E. Coward Dec. 1977 52 p ref
(Contract NAS3-18021)
(NASA-CR-135160; R75AEG511) Avail: NTIS HC A04/MF A01 CSCL 21E

Noise measurements were taken on a turbofan engine which uses the same core, with minor modifications, employed on the quiet clean short-haul experimental engine (QCSEE) propulsion systems. Both nearfield and farfield noise measurements were taken in order to determine the core internally generated noise levels. The resulting noise measurements were compared to predicted combustor and turbine noise levels, to verify or improve the predicted QCSEE combustor and turbine noise levels. Author

N80-15094*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Engineering Div.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) ENGINE COMPOSITE NACELLE TEST REPORT. VOLUME 1: SUMMARY, AERODYNAMIC AND MECHANICAL PERFORMANCE
Apr. 1979 214 p refs
(Contract NAS3-18021)
(NASA-CR-159471; R78AEG573-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 21E

The performance test results of the final under-the-wing engine configuration are presented. One hundred and six hours of engine operation were completed, including mechanical and performance checkout, baseline acoustic testing with a bellmouth inlet, reverse

thrust testing, acoustic technology tests, and limited controls testing. The engine includes a variable pitch fan having advanced composite fan blades and using a ball-spline pitch actuation system. R.E.S.

N80-15095*# General Electric Co., Cincinnati, Ohio. Group Engineering Div.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) PRELIMINARY OVER-THE-WING FLIGHT PROPULSION SYSTEM ANALYSIS REPORT
D. F. Howard Jun. 1977 174 p refs
(Contract NAS3-18021)
(NASA-CR-135296; R77AEG305) Avail: NTIS
HC A08/MF A01 CSCL 21E

The preliminary design of the over-the-wing flight propulsion system installation and nacelle component and systems design features of a short-haul, powered lift aircraft are presented. Economic studies are also presented and show that high bypass, low pressure ratio turbofan engines have the potential of providing an economical propulsion system for achieving the very quiet aircraft noise level of 95 EPNdB on a 152.4 m sideline. R.E.S.

N80-15096*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). UNDER-THE-WING (UTW) ENGINE BOILERPLATE NACELLE TEST REPORT, VOLUME 1 Summary Report
31 Dec. 1977 65 p 3 Vol.
(Contract NAS3-18021)
(NASA-CR-135249; R77AEG2121-Vol-1) Avail: NTIS
HC A04/MF A01 CSCL 21E

The design and testing of high bypass geared turbofan engines with nacelles forming the propulsion systems for short haul passenger aircraft are considered. The test results demonstrate the technology required for externally blown flap aircraft for introduction into passenger service in the 1980's. The equipment tested is described along with the test facility and instrumentation. A chronological history of the test and a summary of results are given. J.M.S.

N80-15097*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). UNDER-THE-WING (UTW) ENGINE BOILERPLATE NACELLE TEST REPORT. VOLUME 3: MECHANICAL PERFORMANCE
31 Dec. 1977 128 p refs 3 Vol.
(Contract NAS3-18021)
(NASA-CR-135251; R77AEG212-Vol-3) Avail: NTIS
HC A07/MF A01 CSCL 21E

Results of initial tests of the under the wing experimental engine and boilerplate nacelle are presented. The mechanical performance of the engine is reported with emphasis on the advanced technology components. Technology elements of the propulsion system covered include: system dynamics, composite fan blades, reduction gear, lube and accessory drive system, fan frame, inlet, core cowl cooling, fan exhaust nozzle, and digital control system. J.M.S.

N80-15098*# General Electric Co., Cincinnati, Ohio.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). COMPOSITE FAN FRAME SUBSYSTEM TEST REPORT
C. L. Stotler, Jr. and J. H. Bowden Sep. 1977 71 p
(Contract NAS3-18021)
(NASA-CR-135010; R76AEG233) Avail: NTIS
HC A04/MF A01 CSCL 21E

The element and subcomponent testing conducted to verify the composite fan frame design of two experimental high bypass geared turbofan engines and propulsion systems for short haul passenger aircraft is described. Emphasis is placed on the propulsion technology required for future externally blown flap aircraft with engines located both under the wing and over the wing, including technology in composite structures and digital engine controls. The element tests confirmed that the processes used in the frame design would produce the predicted mechanical properties. The subcomponent tests verified that the detail structural components of the frame had adequate structural integrity. J.M.S.

N80-15099*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING (OTW) BOILERPLATE NACELLE DESIGN REPORT
May 1977 78 p
(Contract NAS3-18021)
(NASA-CR-135168; R77AEG300) Avail: NTIS
HC A05/MF A01 CSCL 21E

A summary of the mechanical design of the boiler plate nacelle for the QCSEE over the wing (OTW) engine is presented. The nacelle, which features a D-shaped nozzle/thrust reverser and interchangeable hard wall and acoustic panels, is utilized in the engine testing to establish the aerodynamic and acoustic requirements for nozzles and reversers of this type. J.M.S.

N80-15100*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) COMPOSITE NACELLE SUBSYSTEM TEST REPORT
C. L. Stotler, Jr., E. A. Johnston, and D. S. Freeman Jul. 1977 83 p refs
(Contract NAS3-18021)
(NASA-CR-135075; R76AEG420) Avail: NTIS
HC A05/MF A01 CSCL 21E

The element and subcomponent testing conducted to verify the under the wing composite nacelle design is reported. This composite nacelle consists of an inlet, outer cowl doors, inner cowl doors, and a variable fan nozzle. The element tests provided the mechanical properties used in the nacelle design. The subcomponent tests verified that the critical panel and joint areas of the nacelle had adequate structural integrity. J.M.S.

N80-15101*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). BALL SPLINE PITCH CHANGE MECHANISM DESIGN REPORT
Apr. 1978 73 p refs
(Contract NAS3-18021)
(NASA-CR-134873; R77AEG327) Avail: NTIS
HC A04/MF A01 CSCL 21E

Detailed design parameters are presented for a variable-pitch change mechanism. The mechanism is a mechanical system containing a ball screw/spline driving two counteracting master bevel gears meshing pinion gears attached to each of 18 fan blades. R.E.S.

N80-15102*# General Electric Co., Cincinnati, Ohio.
ACOUSTIC ANALYSIS OF AFT NOISE REDUCTION TECHNIQUES MEASURED ON A SUBSONIC TIP SPEED 50.8 cm (TWENTY INCH) DIAMETER FAN
D. L. Stimpert and A. Clemons Jan. 1977 149 p refs
(Contract NAS3-18021)
(NASA-CR-134891; R75AEG368) Avail: NTIS
HC A07/MF A01 CSCL 21E

Sound data which were obtained during tests of a 50.8 cm diameter, subsonic tip speed, low pressure ratio fan were analyzed. The test matrix was divided into two major investigations: (1) source noise reduction techniques; and (2) aft duct noise reduction with acoustic treatment. Source noise reduction techniques were investigated which include minimizing second harmonic noise by varying vane/blade ratio, variation in spacing, and lowering the Mach number through the vane row to lower fan broadband noise. Treatment in the aft duct which includes flow noise effects, faceplate porosity, rotor OGV treatment, slant cell treatment, and splitter simulation with variable depth on the outer wall and constant thickness treatment on the inner wall was investigated. Variable boundary conditions such as variation in treatment panel thickness and orientation, and mixed porosity combined with variable thickness were examined. Significant results are reported. R.C.T.

N80-15103*# Curtiss-Wright Corp., Wood-Ridge, N.J. Power Systems.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) MAIN REDUCTION GEARS TEST PROGRAM Final Report

O. W. Misel Mar. 1977 220 p refs

(Contract NAS3-18021)

(NASA-CR-134869; CW-WR-77-008) Avail: NTIS HC A10/MF A01 CSCL 21E

Sets of under the wing (UTW) engine reduction gears and sets of over the wing (OTW) engine reduction gears were fabricated for rig testing and subsequent installation in engines. The UTW engine reduction gears which have a ratio of 2.465:1 and a design rating of 9712 kW at 3157 rpm fan speed were operated at up to 105% s feed at 60% torque and 100% speed at 125% torque. The OTW engine reduction gears which have a ratio of 2.062:1 and a design rating of 12,615 kW at 3861 rpm fan speed were operated at up to 95% speed at 50% torque and 80% speed at 109% torque. Satisfactory operation was demonstrated at powers up to 12,172 kW, mechanical efficiency up to 99.1% UTW, and a maximum gear pitch line velocity of 112 m/s (22,300 fpm) with a corresponding star gear spherical roller bearing DN of 850,00 OTW. Oil and star gear bearing temperatures, oil churning, heat rejection, and vibratory characteristics were acceptable for engine installation. R.C.T.

N80-15104*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) CLEAN COMBUSTOR TEST REPORT

Oct. 1975 66 p refs

(Contract NAS3-18021)

(NASA-CR-134916; R75AEG449) Avail: NTIS HC A04/MF A01 CSCL 21E

A component pressure test was conducted on a F101 PFRT combustor to evaluate the emissions levels of this combustor design at selected under the wing and over the wing operating conditions for the quiet clean short haul experimental engine (QCSEE). Emissions reduction techniques were evaluated which included compressor discharge bleed and sector burning in the combustor. The results of this test were utilized to compare the expected QCSEE emissions levels with the emission goals of the QCSEE engine program. R.C.T.

N80-15105*# Curtiss-Wright Corp., Wood-Ridge, N.J.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) MAIN REDUCTION GEARS BEARING DEVELOPMENT PROGRAM Final Report

Dec. 1975 40 p

(Contract NAS3-18021)

(NASA-CR-134890) Avail: NTIS HC A03/MF A01 CSCL 21E

The viability of proposed bearing designs to operate at application conditions is described. Heat rejection variables were defined for the test conditions. Results indicate that there is potential for satisfactory operation of spherical roller bearing in the QCSEE main reduction gear application. R.C.T.

N80-15106*# Curtiss-Wright Corp., Wood-Ridge, N.J.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) MAIN REDUCTION GEARS DETAILED DESIGN REPORT Final Report

A. Defeo and M. Kulina Jul. 1977 221 p

(Contract NAS3-18021)

(NASA-CR-134872; CW-WR-77-024) Avail: NTIS HC A10/MF A01 CSCL 21E

Lightweight turbine engines with geared slower speed fans are considered. The design of two similar but different gear ratio, minimum weight, epicyclic star configuration main reduction gears for the under the wing (UTW) and over the wing (OTW) engines is discussed. The UTW engine reduction gear has a ratio of 2.465:1 and a 100% power design rating of 9885 kW (13,256 hp) at 3143 rpm fan speed. The OTW engine reduction gear has a ratio of 2.062:1 and a 100% power design rating of 12813 kW (17183 hp) at 3861 rpm fan speed. Details of configuration, stresses, deflections, and lubrication are presented. J.M.S.

N80-15107*# Hamilton Standard, Windsor Locks, Conn. Aircraft Systems Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE): HAMILTON STANDARD CAM/HARMONIC DRIVE VARIABLE PITCH FAN ACTUATION SYSTEM DETAIL DESIGN REPORT

Mar. 1976 159 p

(Contract NAS3-18021)

(NASA-CR-134852; HSER-7001) Avail: NTIS HC A08/MF A01 CSCL 21E

A variable pitch fan actuation system was designed which incorporates a remote nacelle-mounted blade angle regulator. The regulator drives a rotating fan-mounted mechanical actuator through a flexible shaft and differential gear train. The actuator incorporates a high ratio harmonic drive attached to a multitrack spherical cam which changes blade pitch through individual cam follower arms attached to each blade trunnion. Detail design parameters of the actuation system are presented. These include the following: design philosophies, operating limits, mechanical, hydraulic and thermal characteristics, mechanical efficiencies, materials, weights, lubrication, stress analyses, reliability and failure analyses. Author

N80-15108*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING ENGINE COMPOSITE FAN BLADE DESIGN REPORT Final Report

R. Ravenhall and C. T. Salemme Feb. 1977 61 p refs

(Contract NAS3-18021)

(NASA-CR-135046; R77AEG177) Avail: NTIS HC A04/MF A01 CSCL 21E

A total of 38 quiet clean short haul experimental engine under the wing composite fan blades were manufactured for various component tests, process and tooling, checkout, and use in the QCSEE UTW engine. The component tests included frequency characterization, strain distribution, bench fatigue, platform static load, whirligig high cycle fatigue, whirligig low cycle fatigue, whirligig strain distribution, and whirligig overspeed. All tests were successfully completed. All blades planned for use in the engine were subjected to and passed a whirligig proof spin test. R.C.T.

N80-15109*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE): THE AERODYNAMIC AND MECHANICAL DESIGN OF THE QCSEE UNDER-THE-WING FAN

Mar. 1977 144 p

(Contract NAS3-18021)

(NASA-CR-135009; R75AEG484) Avail: NTIS HC A07/MF A01 CSCL 21E

The design, fabrication, and testing of two experimental high bypass geared turbofan engines and propulsion systems for short haul passenger aircraft are described. The aerodynamic and mechanical design of a variable pitch 1.34 pressure ratio fan for the under the wing (UTW) engine are included. The UTW fan was designed to permit rotation of the 18 composite fan blades into the reverse thrust mode of operation through both flat pitch and stall pitch directions. R.C.T.

N80-15110*# General Electric Co., Cincinnati, Ohio.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) COMPOSITE FAN FRAME DESIGN REPORT

S. C. Mitchell Sep. 1978 97 p refs

(Contract NAS3-18021)

(NASA-CR-135278; R77AEG439) Avail: NTIS HC A04/MF A01 CSCL 21E

An advanced composite frame which is flight-weight and integrates the functions of several structures was developed for the over the wing (OTW) engine and for the under the wing (UTW) engine. The composite material system selected as the basic material for the frame is Type AS graphite fiber in a Hercules 3501 epoxy resin matrix. The frame was analyzed using a finite element digital computer program. This program was used in an iterative fashion to arrive at practical thicknesses and ply orientations to achieve a final design that met all strength and stiffness requirements for critical conditions. Using

this information, the detail design of each of the individual parts of the frame was completed and released. On the basis of these designs, the required tooling was designed to fabricate the various component parts of the frame. To verify the structural integrity of the critical joint areas, a full-scale test was conducted on the frame before engine testing. The testing of the frame established critical spring constants and subjected the frame to three critical load cases. The successful static load test was followed by 153 and 58 hours respectively of successful running on the UTW and OTW engines. J.M.S.

N80-15111*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UTW FAN PRELIMINARY DESIGN
Feb. 1975 107 p
(Contract NAS3-18021)
(NASA-CR-134842; R75AEG213) Avail: NTIS
HC A06/MF A01 CSCL 21E

High bypass geared turbofan engines and propulsion systems designed for short-haul passenger aircraft are described. The propulsion technology required for future externally blown flap aircraft with engines located both under the wing and over the wing is emphasized. The aerodynamic and mechanical preliminary design of the QCSEE under the wing 1.34 pressure ratio fan with variable blade pitch is presented. Design information is given for two pitch change actuation systems which will provide reverse thrust. J.M.S.

N80-15112*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE): THE AERODYNAMIC AND PRELIMINARY MECHANICAL DESIGN OF THE QCSEE OTW FAN
Feb. 1975 80 p
(Contract NAS3-18021)
(NASA-CR-134841; R75AEG381) Avail: NTIS
HC A05/MF A01 CSCL 21E

The aerodynamic and mechanical preliminary design of the QCSEE over the wing 1.36 pressure ratio fan is presented. Design information is given for both the experimental and flight designs. J.M.S.

N80-15113*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING ENGINE COMPOSITE FAN BLADE DESIGN
May 1975 57 p
(Contract NAS3-18021)
(NASA-CR-134840; R75AEG278) Avail: NTIS
HC A04/MF A01 CSCL 21E

The design and analysis of a composite fan blade for the under the wing (UTW) QCSEE is presented. The blade is designed for a variable pitch, 18 bladed rotor and is constructed from a hybrid composite combination of materials consisting of Kevlar-49, type AS graphite, boron, and S-glass fibers in a PR288 epoxy resin matrix. The blade has an attached platform which is constructed of AS-graphite, PR278 epoxy resin matrix and aluminum honeycomb. The blade is designed to satisfy aerostability and cyclic life and strength requirements with a light weight construction. The attached platform is designed for a fail-safe condition in that it is retainable by the blade, under centrifugal force loading, even in the event of blade to platform bond separation. Details of the blade design and the results of stress, vibration, and impact analysis are included. J.M.S.

N80-15114*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING ENGINE AND CONTROL SIMULATION RESULTS
Oct. 1978 107 p refs
(Contract NAS3-18021)
(NASA-CR-135049; R76AEG218) Avail: NTIS
HC A06/MF A01 CSCL 21E

A hybrid-computer simulation of the over the wing turbofan engine was constructed to develop the dynamic design of the control. This engine and control system includes a full authority digital electronic control using compressor stator reset to achieve fast thrust response and a modified Kalman filter to correct for sensor failures. Fast thrust response for powered-lift operations and accurate, fast responding, steady state control of the engine is provided. Simulation results for throttle bursts from 62 to 100 percent takeoff thrust predict that the engine will accelerate from 62 to 95 percent takeoff thrust in one second. J.M.S.

N80-15115*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) BALL SPLINE PITCH-CHANGE MECHANISM WHIRLIGIG TEST REPORT
Sep. 1978 64 p refs
(Contract NAS3-18021)
(NASA-CR-135354; R77AEG394) Avail: NTIS
HC A04/MF A01 CSCL 21E

The component testing of a ball spline variable pitch mechanism is described including a whirligig test. The variable pitch actuator successfully completed all planned whirligig tests including a fifty cycle endurance test at actuation rates up to 125 deg per second at up to 102 percent fan speed (3400 rpm). J.M.S.

N80-15116*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) BOILER PLATE NACELLE AND CORE EXHAUST NOZZLE DESIGN REPORT
Oct. 1976 104 p
(Contract NAS3-18021)
(NASA-CR-135008; R76AEG222) Avail: NTIS
HC A06/MF A01 CSCL 21E

The mechanical design of the boiler plate nacelle and core exhaust nozzle for the QCSEE under the wing engine is presented. The nacelle, which features interchangeable hard-wall and acoustic panels, is to be utilized in the initial engine testing to establish acoustic requirements for the subsequent composite nacelle as well as in the QCSEE over the wing engine configuration. J.M.S.

N80-15117*# Hamilton Standard, Windsor Locks, Conn.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) WHIRL TEST OF CAM/HARMONIC PITCH CHANGE ACTUATION SYSTEM Contractor Report, 10 Nov. 1975 - 16 Feb. 1976
Apr. 1976 208 p refs
(Contract NAS3-18021)
(NASA-CR-135140; HSER-7002) Avail: NTIS
HC A10/MF A01 CSCL 21E

A variable pitch fan actuation system, which incorporates a remote nacelle mounted blade angle regulator, was tested. The regulator drives a rotating fan mounted mechanical actuator through a flexible shaft and differential gear train. The actuator incorporates a high ratio harmonic drive attached to a multitrack spherical cam which changes blade pitch through individual cam follower arms attached to each blade trunnion. Testing of the actuator on a whirl rig, is reported. Results of tests conducted to verify that the unit satisfied the design requirements and was structurally adequate for use in an engine test are presented. J.M.S.

N80-15118*# General Electric Co., Cincinnati, Ohio.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING (OTW) PROPULSION SYSTEMS TEST REPORT. VOLUME 4: ACOUSTIC PERFORMANCE
D. L. Stimpert Feb. 1979 144 p refs
(Contract NAS3-18021)
(NASA-CR-135326; R77AEG476-Vol-4) Avail: NTIS
HC A07/MF A01 CSCL 21E

A series of acoustic tests were conducted on the over the wing engine. These tests evaluated the fully suppressed noise levels in forward and reverse thrust operation and provided insight into the component noise sources of the engine plus the suppression achieved by various components. System noise levels using the contract specified calculation procedure indicate that the in-flight noise level on a 152 m sideline at takeoff and

approach are 97.2 and 94.6 EPNdB, respectively, compared to a goal of 95.0 EPNdB. In reverse thrust, the system noise level was 106.1 PNdB compared to a goal of 100 PNdB. Baseline source noise levels agreed very well with pretest predictions. Inlet-radiated noise suppression of 14 PNdB was demonstrated with the high throat Mach number inlet at 0.79 throat Mach number. R.E.S.

N80-15119*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) COMPOSITE NACELLE Final Design Report

E. A. Johnston Aug. 1978 128 p

(Contract NAS3-18021)

(NASA-CR-135352; R77AEG588) Avail: NTIS HC A07/MF A01 CSCL 21E

The detail design of the under the wing experimental composite nacelle components is summarized. Analysis of an inlet, fan bypass duct doors, core cowl doors, and variable fan nozzle are given. The required technology to meet propulsion system performance, weight, and operational characteristics is discussed. The materials, design, and fabrication technology for quiet propulsion systems which will yield installed thrust to weight ratios greater than 3.5 to 1 are described. R.C.T.

N80-15120*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) Final Report

William S. Willis Aug. 1979 408 p refs

(Contract NAS3-18021)

(NASA-CR-159473; R79AEG478) Avail: NTIS HC A18/MF A01 CSCL 21E

The design, fabrication, and testing of two experimental propulsion systems for powered lift transport aircraft are given. The under the wing (UTW) engine was intended for installation in an externally blown flap configuration and the over the wing (OTW) engine for use in an upper surface blowing aircraft. The UTW engine included variable pitch composite fan blades, main reduction gear, composite fan frame and nacelle, and a digital control system. The OTW engine included a fixed pitch fan, composite fan frame, boilerplate nacelle, and a full authority digital control. Many acoustic, pollution, performance, and weight goals were demonstrated. R.C.T.

N80-15121*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). DOUBLE-ANNULAR CLEAN COMBUSTOR TECHNOLOGY DEVELOPMENT REPORT

D. W. Bahr, D. L. Burrus, and P. E. Sabla May 1979 149 p refs

(Contract NAS3-18021)

(NASA-CR-159483; R79AEG397) Avail: NTIS HC A07/MF A01 CSCL 21E

A sector combustor technology development program was conducted to define an advanced double annular dome combustor sized for use in the quiet clean short haul experimental engine (QCSEE). A design which meets the emission goals, and combustor performance goals of the QCSEE engine program was developed. Key design features were identified which resulted in substantial reduction in carbon monoxide and unburned hydrocarbon emission levels at ground idle operating conditions, in addition to very low nitric oxide emission levels at high power operating conditions. Their significant results are reported. R.C.T.

N80-15122*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE): ACOUSTIC TREATMENT DEVELOPMENT AND DESIGN

Art Clemons May 1979 353 p refs

(Contract NAS3-18021)

(NASA-CR-135266; R78AEG379-1) Avail: NTIS HC A16/MF A01 CSCL 21E

Acoustic treatment designs for the quiet clean short-haul experimental engines are defined. The procedures used in the development of each noise-source suppressor device are presented and discussed in detail. A complete description of all treatment concepts considered and the test facilities utilized in obtaining background data used in treatment development are also described. Additional supporting investigations that are complementary to the treatment development work are presented. The expected suppression results for each treatment configuration are given in terms of delta SPL versus frequency and in terms of delta PNdB. R.E.S.

N80-15123*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QSCEE). PRELIMINARY ANALYSES AND DESIGN REPORT, VOLUME 1

Oct. 1974 372 p

(Contract NAS3-18021)

(NASA-CR-134838; R74AEG479-Vol-1) Avail: NTIS HC A16/MF A01 CSCL 21E

The experimental propulsion systems to be built and tested in the 'quiet, clean, short-haul experimental engine' program are presented. The flight propulsion systems are also presented. The following areas are discussed: acoustic design; emissions control; engine cycle and performance; fan aerodynamic design; variable-pitch actuation systems; fan rotor mechanical design; fan frame mechanical design; and reduction gear design. R.E.S.

N80-15124*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE). PRELIMINARY ANALYSES AND DESIGN REPORT, VOLUME 2

Oct. 1974 330 p

(Contract NAS3-18021)

(NASA-CR-134839; R74AEG479-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 21E

The experimental and flight propulsion systems are presented. The following areas are discussed: engine core and low pressure turbine design; bearings and seals design; controls and accessories design; nacelle aerodynamic design; nacelle mechanical design; weight; and aircraft systems design. R.E.S.

N80-15125*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE-WING (OTW) PROPULSION SYSTEM TEST REPORT. VOLUME 1: SUMMARY REPORT

Jan. 1978 67 p

(Contract NAS3-18021)

(NASA-CR-135323; R77AEG473-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 21E

Sea level, static, ground testing of the over-the-wing engine and boilerplate nacelle components was performed. The equipment tested and the test facility are described. Summaries of the instrumentations, the chronological history of the tests, and the test results are presented. R.E.S.

N80-15126*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.

QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) OVER-THE WING (OTW) PROPULSION SYSTEM TEST REPORT. VOLUME 3: MECHANICAL PERFORMANCE

Feb. 1978 121 p

(Contract NAS3-18021)

(NASA-CR-135325; R77AEG475-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 21E

The mechanical performance of the over-the-wing engine is described with emphasis on the advanced technology components. The overall dynamic response of the engine was excellent.R.E.S.

N80-15127*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

QUIET POWERED-LIFT PROPULSION

1979 426 p refs Conf. held at Cleveland, Ohio, 14-15 Nov. 1978

(NASA-CP-2077; E-9906) Avail: NTIS HC A19/MF A01 CSCL 21E

Latest results of programs exploring new propulsion technology for powered-lift aircraft systems are presented. Topics discussed include results from the 'quiet clean short-haul experimental engine' program and progress reports on the 'quiet short-haul research aircraft' and 'tilt-rotor research aircraft' programs. In addition to these NASA programs, the Air Force AMST YC 14 and YC 15 programs were reviewed. R.E.S.

N80-15128*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DIRECT INTEGRATION OF TRANSIENT ROTOR DYNAMICS

Albert F. Kascak Washington Jan. 1980 23 p refs

(NASA-TP-1587; AVRADCOM-TR-79-42; E-101) Avail: NTIS HC A02/MF A01 CSCL 21E

An implicit method was developed for integrating the equations of motion for a lumped mass model of a rotor dynamics system. As an aside, a closed form solution to the short bearing theory was also developed for a damper with arbitrary motion. The major conclusions are that the method is numerically stable and that the computation time is proportional to the number of elements in the rotor dynamics model rather than to the cube of the number. This computer code allowed the simulation of a complex rotor bearing system experiencing nonlinear transient motion and displayed the vast amount of results in an easily understood motion picture format - a 10 minute, 16 millimeter, color, sound motion picture supplement. An example problem with 19 mass elements in the rotor dynamics model took 0.7 second of central processing unit time per time step on an IBM 360-67 computer in a time sharing mode. R.C.T.

N80-15129*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EVALUATION OF APPROXIMATE METHODS FOR THE PREDICTION OF NOISE SHIELDING BY AIRFRAME COMPONENTS

Warren F. Ahtye and Geraldine McCulley (Informatics, Inc., Palo Alto, Calif.) Washington Jan. 1980 105 p refs

(NASA-TP-1004; A-6961) Avail: NTIS HC A06/MF A01 CSCL 21E

An evaluation of some approximate methods for the prediction of shielding of monochromatic sound and broadband noise by aircraft components is reported. Anechoic-chamber measurements of the shielding of a point source by various simple geometric shapes were made and the measured values compared with those calculated by the superposition of asymptotic closed-form solutions for the shielding by a semi-infinite plane barrier. The shields used in the measurements consisted of rectangular plates, a circular cylinder, and a rectangular plate attached to the cylinder to simulate a wing-body combination. The normalized frequency, defined as a product of the acoustic wave number and either the plate width or cylinder diameter, ranged from 4.6 to 114. Microphone traverses in front of the rectangular plates and cylinders generally showed a series of diffraction bands that matched those predicted by the approximate methods, except for differences in the magnitudes of the attenuation minima which can be attributed to experimental inaccuracies. The shielding of wing-body combinations was predicted by modifications of the approximations used for rectangular and cylindrical shielding. Although the approximations failed to predict diffraction patterns in certain regions, they did predict the average level of wing-body shielding with an average deviation of less than 3 dB. M.M.M.

N80-15130*# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

THEORY OF DEPOSITION OF CONDENSIBLE IMPURITIES ON SURFACES IMMERSED IN COMBUSTION GASES Semiannual Report, 15 Jan. - 14 Jul. 1979

Daniel E. Rosner 1979 11 p refs

(Grant NsG-3107)

(NASA-CR-159716; SAR-6) Avail: NTIS HC A02/MF A01 CSCL 21E

The components resulting from the deposition of inorganic salts (e.g., Na2SO4) and oxides present in the combustion products from gas turbine engines were investigated. Emphasis was placed on the effects of multicomponent vapor transport, thermophoretic transport of vapor and small particles to actively cooled surfaces, variable fluid properties within mass transfer boundary layers, and free stream turbulence. R.C.T.

N80-15131*# Yale Univ., New Haven, Conn. High Temperature Chemical Reaction Engineering Lab.

EXPERIMENTAL STUDIES OF THE FORMATION/DEPOSITION OF SODIUM SULFATE IN/FROM COMBUSTION GASES Semiannual Report, 15 May - 15 Dec. 1979

Daniel E. Rosner Dec. 1979 10 p refs

(Grant NsG-3169)

(NASA-CR-159753; SAR-4) Avail: NTIS HC A02/MF A01 CSCL 21E

An optical polarization (ellipsometric) technique was developed for measuring rapidly growing and evaporating transparent liquid condensate films (e.g., boric oxide) on solid surfaces exposed to combustion product gases. Results for the B2O3 deposition rate from BCl3-seeded propane/air flames are shown to agree well with the results of earlier interference measurements, and also with theoretical CVD predictions. Evaporation rates (from platinum ribbons into seeded propane air flames) are estimated using the polarization technique. It appears that, compared with the interference method, the polarization technique places less stringent requirements on surface quality, which may justify the added optical components needed for such measurements. It is concluded that the complementary optical methods of polarization (ellipsometry) and interference hold considerable promise for application to the rapid measurement of condensation and evaporation rates in high temperature (e.g., combustion product) environments. A.R.H.

N80-15132*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPUTER SIMULATION OF ENGINE SYSTEMS

L. H. Fishback 1980 26 p refs Presented at the 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA

(NASA-TM-79290; E-234) Avail: NTIS HC A03/MF A01 CSCL 21E

The use of computerized simulations of the steady state and transient performance of jet engines throughout the flight regime is discussed. In addition, installation effects on thrust and specific fuel consumption is accounted for as well as engine weight, dimensions and cost. The availability throughout the government and industry of analytical methods for calculating these quantities are pointed out. M.M.M.

N80-15133*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IMPACT OF NEW INSTRUMENTATION ON ADVANCED TURBINE RESEARCH

Robert W. Graham Mar. 1980 25 p refs Proposed for presentation at the 1980 Spring Ann. Meeting, New Orleans, 5-13 Mar. 1980; sponsored by ASME

(NASA-TM-79301; E-251) Avail: NTIS HC A02/MF A01 CSCL 21E

A description is presented of an orderly test program that progresses from the simplest stationary geometry to the more complex, three dimensional, rotating turbine stage. The instrumentation requirements for this evolution of testing are described. The heat transfer instrumentation is emphasized. Recent progress made in devising new measurement techniques has greatly improved the development and confirmation of more accurate analytical methods for the prediction of turbine performance and heat transfer. However, there remain challenging requirements for novel measurement techniques that could advance the future research to be done in rotating blade rows of turbomachines. M.M.M.

N80-15134*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN ANALYTICAL AND EXPERIMENTAL STUDY OF A SHORT S-SHAPED SUBSONIC DIFFUSER OF A SUPERSONIC INLET

Harvey E. Neumann, Louis A. Povinelli, and Robert E. Coltrin 1980 14 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan 1980; sponsored by AIAA

(NASA-TM-81406; E-320) Avail: NTIS HC A02/MF A01 CSCL 21E

A subscale HiMAT forebody and inlet was investigated over a range of Mach numbers to 1.4. The inlet exhibited a transitory separation within the diffuser but steady state data indicated reattachment at the diffuser exit. A finite difference procedure for turbulent compressible flow in axisymmetric ducts was used to successfully model the HiMAT duct flow. The analysis technique was further used to estimate the initiation of separation and delineate the steady and unsteady flow regimes in similar S-shaped ducts. R.C.T.

N80-15135# Boeing Aerospace Co., Seattle, Wash.
AN EXTENSION OF ENGINE WEIGHT ESTIMATION TECHNIQUES TO COMPUTE ENGINE PRODUCTION COST Final Report
E. Onat and F. F. Tolle 31 Aug. 1979 38 p refs
(Contract N62269-78-C-0286)
(AD-A074454; NADC-78103-60) Avail: NTIS HC A03/MF A01 CSCL 05/1

As a follow-on to previously developed engine weight estimation work, a preliminary design engine cost estimating code has been produced. The code relies on engine thermodynamic characteristics and weight as computed by earlier developed codes to select raw material types and quantities required to produce the engine. An existing Navy technique is then used to convert this data into engine cost. The code was used to predict the cost of three existing engines; errors ranged form 1 to 8% of actual costs as reported to NADC. GRA

N80-15136# Kentucky Univ., Lexington. Dept. of Engineering Mechanics.
THERMO-MECHANICAL STRESS ANALYSIS OF ADVANCED TURBINE BLADE COOLING CONFIGURATION *Final Report, 1 May 1975 - 15 Jul. 1979*
F. J. Rizzo and D. J. Shippy Jul. 1974 68 p refs
(Grant AF-AFOSR-2824-79; AF Proj. 2307)
(AD-A074098; UKY-TR111-79-EM17; AFOSR-79-0953TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

A thermo-mechanical stress analysis capability, based on the Boundary Integral Equation Method (BIE) is developed and described. The capability is used to provide a thermoelastic analysis of stress in the vicinity of cooling holes in turbojet blades with transpiration or film cooling. Details involved in the formulation, numerical procedures, mathematical modelling, and data from solved problems are presented. GRA

N80-15137# TRW Equipment Labs., Cleveland, Ohio. Materials Technology Dept.
***FRS COMPOSITES FOR ADVANCED GAS TURBINE ENGINE COMPONENTS* Final Report**
D. M. Essock May 1979 46 p refs
(Contract N62269-77-C-0217; SF54592201)
(AD-A074287; ER-7969-F; NADC-77015-30) Avail: NTIS HC A03/MF A01 CSCL 20/5

A number of FRS design concepts involve use of varying volume fraction of fiber, varying fiber diameter, and cross-ply construction. Key properties of such composites were evaluated to determine whether there are any adverse effects. Based upon elevated temperature tensile, creep, and thermal fatigue testing, equivalent mechanical properties are obtained if placement of plies is varied in a symmetrical layup. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-15138*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF PRIMARY ROTOR PARAMETERS ON FLAPPING DYNAMICS
Robert T. N. Chen Jan. 1980 63 p refs
(NASA-TP-1431; A-7777) Avail: NTIS HC A04/MF A01 CSCL 01A

The effects of flapping dynamics of four main rotor design features that influence the agility, stability, and operational safety of helicopters are studied. The parameters include flapping hinge offset, flapping hinge restraint, pitch-flap coupling, and blade lock number. First, the flapping equations of motion are derived that explicitly contain the design parameters. The dynamic equations are then developed for the tip-path plane, and the influence of individual and combined variations in the design parameters determined. The steady state flapping response is examined with respect to control input and aircraft angular rate which leads to a feedforward control law for control decoupling through cross feed, and a feedback control law to decouple the steady state flapping response. The condition for achieving perfect decoupling of the flapping response due to aircraft pitch and roll rates without using feedback control is also found for the hover case. It is indicated that the frequency of the regressing flapping mode of the rotor system can become low enough to require consideration in the assessment of handling characteristics. J.M.S.

N80-15139# Calspan Advanced Technology Center, Buffalo, N.Y.
DESIGN CRITERIA FOR OPTIMAL FLIGHT CONTROL SYSTEMS *Final Report, Jan. - Nov. 1978*
K. S. Govindara, E. G. Rynaski, and A. T. Fam 7 Sep. 1979 95 p refs Prepared in cooperation with the State Univ. of New York at Buffalo
(Contract N00014-78-C-0155)
(AD-A074092; CALSPAN-6248-F-1; ONR-CR-215-259-1F) Avail: NTIS HC A05/MF A01 CSCL 01/3

Discussed is the application of linear optimal control to the design of a multicontroller feedback system to satisfy aircraft flying qualities criteria. The problem addressed is that of relating the performance index weighting matrices to the poles and zeros of the closed-loop transfer functions. Two sequential design procedures, one computing the Riccati solution from a set of linear equations and the other computing the closed-loop eigenvectors, are presented that determine, at each step, the pole-zero movements of the closed-loop transfer functions as the weighting matrix on the states is varied for a given weighting matrix on the controls. The performance index matrix constructed at each step to move the poles and zeros is added to get a final performance index matrix that moves the open-loop poles and zeros to more desirable locations. A control system design example with the X-22A V/STOL aircraft as the model, and using the first sequential design procedures, is presented. Two alternative design techniques are also presented. The first is based upon the Riccati equation solution and the control weighting matrix rather than on the weighting matrices on the states and control, and in the second design technique, the change in the pole-zero locations is determined under perturbations in the performance index matrices. GRA

N80-15140# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE 28TH GUIDANCE AND CONTROL PANEL SYMPOSIUM ON ADVANCES IN GUIDANCE AND CONTROL SYSTEMS USING DIGITAL TECHNIQUES
Morris A. Ostgaard (AFFDL, Wright-Patterson AFB, Ohio) Nov. 1979 14 p Symp. held at Ottawa, 8-11 May 1979
(AGARD-AR-148; ISBN-92-835-1314-X) Avail: NTIS HC A02/MF A01

A summary of the conclusions and recommendations resulting from audience comments and participation and technical assessment of the papers and the meeting is presented. Some of the conclusions are as follows: (1) there is a rapid emergence of digital processor application to guidance and control that represent integration opportunities heretofore unavailable in analog systems; (2) there appears to be a proliferation of microprocessor device application and architectures that, by themselves, limit potential for generalized application; (3) with the availability of more information from the data buss and the power of the computational capability, the multi-variable design techniques are offering significant potential for improving system performance and reducing equipment complexity; and (4) there is a strong need for fundamental studies in functional architecture that can employ microprocessors and still retain standards that permit

the application of emerging electronic technology without restructuring the total system. R.E.S.

N80-15141# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
LOW COST AIRCRAFT FLUTTER CLEARANCE
Sep. 1979 110 p Papers presented at the 48th Meeting of the Structures and Mater. Panel, Williamsburg, Va., 4 Apr. 1979
(AGARD-CP-278; ISBN-92-835-0245-0) Avail: NTIS HC A06/MF A01

An evaluation of the usage of low cost aircraft flutter clearance procedures is presented. Some results occurring from such procedures (weight efficiency, safety, flight incidents, and overall costs) were discussed relative to those from methods using advanced state of the art. The relative technological-financial position of the small light weight aircraft manufacturer was also discussed. For individual titles, see N80-15142 through N80-15148.

N80-15142# Lockheed-Georgia Co., Marietta.
COMPARISON OF INTERNATIONAL FLUTTER REQUIREMENTS AND FLUTTER FREEDOM SUBSTANTIATION OF LIGHT AIRCRAFT IN THE USA
H. F. Hunter and G. E. Goodblood (FAA) *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 10 p refs (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

A comparison of current flutter specification requirements for light aircraft produced by NATO and other free-world countries is presented as well as an overview of flutter substantiation procedures presently used in the USA by the Federal Aviation Administration. Current flutter assessment procedures for light aircraft parallel very nearly those for transport-type aircraft. Significant deviations could occur because specific requirements for follow-on flight verification are lacking. The lack of such requirements has not created a great problem, since certain elements of the flight structure call for flight demonstration, in most cases. The body of data acquired may be something less than that derived for a transport program. The attempt is made, however, to acquire sufficient data to validate the analysis from a safety standpoint. M.M.M.

N80-15143# Beech Aircraft Corp., Wichita, Kans. Structural Dynamics Dept.
THE STATE-OF-THE-ART OF FLUTTER SUBSTANTIATION PROCEDURES AMONG US GENERAL AVIATION MANUFACTURERS
E. H. Hooper *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 19 p ref (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

An overview is presented of the state of the art of flutter substantiation procedures among U.S. general aviation manufacturers to serve as a guide to the small plane designer in the prevention of flutter, aileron reversal, and wing divergence. The material presented relies upon: (1) a statistical study of the geometric, inertia, and elastic properties of those airplanes which had experienced flutter in flight, and the methods used to eliminate the flutter; (2) limited wind-tunnel tests conducted with semi-rigid models. These were solid models of high rigidity with motion controlled at the root by springs to simulate wing bending and torsion. Springs at the control surface were used to simulate rotation; and (3) analytic studies based on the two dimensional study of a representative section of an airfoil. M.M.M.

N80-15144# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
AN EMPIRICAL APPROACH FOR CHECKING FLUTTER STABILITY OF GLIDERS AND LIGHT AIRCRAFT
F. Kiessling *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 17 p refs (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

Data of flutter accidents and computations of gliders and light aircraft are presented, and the empirical rules of a simplified flutter investigation are applied. A procedure for checking the flutter stability of small airplanes is proposed, which takes into account the varying levels of knowledge with conventional and unconventional designs. M.M.M.

N80-15145# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DYNAMIC IDENTIFICATION OF LIGHT AIRCRAFT STRUCTURES AND THEIR FLUTTER CERTIFICATION
Gerard Piazzoli and Jean-Louis Meurzec *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 19 p refs In FRENCH; ENGLISH summary (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

Within the framework of the general orientation of the treatment of the light aircraft structures, and with a view to determining specifications for their aeroelastic certification, the following points are discussed: (1) application of fast identification methods and of technological means to be implemented during the tests; (2) exploitation of flutter onset calculations, coupled on the computer with the experimental data, making it possible, in most cases, to define in situ a remedy (such as a new mass balance of the control surface) and to check its efficiency; (3) development of mixed methods, based on the theoretical definition of the participation of the control surfaces in the structural modes revealed by the test, with a view to palliating the possible orthogonally defects of the experimental modal basis on which the definitive flutter prediction calculations are established; and (4) methods and techniques used during the aeroelastic flight test, carried out in the particular cases where flutter certification cannot be based only on the calculation file because of insufficient safety margins. M.M.M.

N80-15146# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
A SIMPLIFIED GROUND VIBRATION TEST PROCEDURE FOR SAILPLANES AND LIGHT AIRCRAFT
N. Niedbal *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 11 p refs (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

A test procedure to obtain all characteristic modal data for an aeroelastic analysis is presented. It is shown that by taking into consideration the beam-like structural behaviour of such aircraft, and the comparatively small bandwidth of the design variables, substantial simplifications are possible when the dynamic behavior of similar aircraft structures is known. The mechanical steering mechanism of the control surfaces causes high damping and nonlinear effects, which require a separate examination and analysis of the control surfaces. M.M.M.

N80-15147# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
A FLUTTER-SPEED FORMULA FOR WINGS OF HIGH ASPECT RATIO
D. T. Niblett *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 14 p refs (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

Flutter-speed formulae for unswept wings of high aspect ratio and not carrying concentrated masses are derived. A high aspect ratio wing was defined as one whose fundamental torsional frequency is well above its first overtone flexural frequency. Because of the comparative fewness of the factors governing the flutter of such wings, flutter-speed formulae aimed at giving a lower bound for the flutter speed is of simple form. M.M.M.

N80-15148# British Aerospace Aircraft Group, Weybridge (England). Weybridge-Bristol Div.
THE MINIMUM COST APPROACH TO FLUTTER CLEARANCE
B. W. Payne and R. E. J. Brazier *In* AGARD Low Cost Aircraft Flutter Clearance Sep. 1979 11 p (For primary document see N80-15141 06-08)
Avail: NTIS HC A06/MF A01

Flutter prediction methods are assessed using criteria and simple flutter analyses. The difference in cost of these alternative approaches is no longer great, and the better data, available from the flutter analysis, answer far more of the questions which arise when obtaining a flutter clearance. Current regulations,

although not making flutter calculations mandatory, do insist on ground and flight resonance testing. Data from a flutter analysis can allow a substantial saving in flight test time. It is concluded that flutter calculations provide the swiftest, surest and safest route to flutter clearance of the orthodox design and the only route for the unorthodox. Author

N80-15149# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AERODYNAMIC CHARACTERISTICS OF CONTROLS
Sep. 1979 510 p Presented at the Fluid Dyn. Panel Symp., Pozzuoli, Italy, 14-17 May 1979
(AGARD-CP-262; ISBN-92-835-0252-3) Avail: NTIS HC A22/MF A01

The rapidly expanding flight envelopes of aircraft, the growing applications of active control technology (ACT) and the associated development of control configured vehicles (CCV) are considered. Conventional and novel methods of control, prediction methods, experimental data derived from wind tunnel and flight measurements, and flight experience of ACT and CCV are included. For individual titles, see N80-15150 through N80-15178.

N80-15150# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Design Aerodynamics.
THEORETICAL AERODYNAMIC METHODS FOR ACTIVE CONTROL DEVICES
Horst Koerner *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 28 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The theoretical aerodynamic aspects of active control devices are surveyed. Various calculation methods for subsonic, transonic, and supersonic attached flow are reviewed followed by comments on separated flow. Typical correlations between theoretical and experimental results for steady and unsteady characteristics of control are presented along with the shortcomings of the theoretical approaches and some recommendations for future efforts. J.M.S.

N80-15151# Royal Aircraft Establishment, Farnborough (England).
A SURVEY OF EXPERIMENTAL DATA ON THE AERODYNAMICS OF CONTROLS, IN THE LIGHT OF FUTURE NEEDS
A. Jean Ross and H. H. B. M. Thomas *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 48 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Control data for current aircraft are used to provide material for discussion, principally to describe trends and to highlight gaps in knowledge. Both direct and indirect effects for a range of conventional and unconventional motivators are included. Maximum control power at the extremes of the flight envelope is particularly emphasized, since that available at high angle of attack and high subsonic speed is likely to be the critical design case. The indirect and coupling effects are also more marked at high angle of attack and/or high control deflection, and are of importance in the control system design. Hinge moment characteristics are described, although experimental data published recently are sparse. Some thought is given to the means of generating required control powers for aircraft configurations made possible by Active Control Technology, and to the integration of the motivators in the control system. J.M.S.

N80-15152# McDonnell Aircraft Co., St. Louis, Mo.
CORRELATION OF F-15 FLIGHT AND WIND TUNNEL TEST CONTROL EFFECTIVENESS
J. W. Agnew and J. F. Mello *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 11 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The F-15 aerodynamic configuration and control system development relied on data obtained in an extensive wind tunnel test program. Subsequently, a large body of flight test data was obtained. Control surface effectiveness characteristics were derived from flight test data and were compared with the data obtained in the wind tunnel test program. Data correlations are available for the ailerons, rudders, and stabilators. The latter surfaces are deflected symmetrically for longitudinal control and are deflected differentially for roll control. Primary axis effectiveness is addressed for each of these control surfaces. Significant secondary axis contributions (e.g., yawing moments due to aileron deflection) are also addressed. In addition to the conventional control surfaces, the longitudinal control effectiveness of the F-15 movable inlet ramp is discussed. As a result of the excellent resistance to departure from controlled flight, the spin resistance and spin recovery characteristics of the F-15, it was possible to flight test and to obtain control effectiveness data to 90 deg angle of attack at low speeds and to approximately 40 deg at transonic speeds. Thus, the correlation of control effectiveness is addressed for a large range of conditions. J.M.S.

N80-15153# Royal Aircraft Establishment, Farnborough (England).
SOME WIND TUNNEL MEASUREMENTS OF THE EFFECTIVENESS AT LOW SPEEDS OF COMBINED LIFT AND ROLL CONTROLS
D. S. Woodward, R. F. A. Keating, and C. S. Barnes *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 36 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Using a half-model technique, measurements were made, at low speeds, of the effectiveness of spoilers for direct lift or roll control, with high lift devices deployed. The wing planform was representative of that of a transport aircraft outboard of the trailing edge crank. Results are presented which show that appropriate venting beneath the leading edge of hinged plate spoilers, together with venting through the flap shroud, achieved acceptably linear spoiler characteristics. Similarly, linear characteristics were obtained for a vented spoiler formed by moving the rear of the flap shroud. No reversal of spoiler effectiveness was found at any test condition within the normal operating range of incidence. In the same way, measurements were made of the maximum lift and roll performance of a typical swing wing fighter aircraft, for which the design of the leading and trailing edge controls was totally determined by the need to maximize the maneuverability at high speed. The maximum lift performance is compared with that obtainable from conventional slate and slotted flaps. Somewhat surprisingly, it is found that adequate rolling moments can be obtained by using full-span plain flaps differentially about a basic drooped position of 30 deg. J.M.S.

N80-15154# Boeing Military Airplane Development, Seattle, Wash. Flight Control Technology.
FLIGHT CONTROL AND CONFIGURATION DESIGN CONSIDERATIONS FOR HIGHLY MANEUVERABLE AIRCRAFT
William T. Kehrer *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 11 p (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Working within wing geometry and other design constraints, the controllable limits of instability and the maneuver capabilities of various design approaches were investigated. Preliminary studies conducted to evaluate competitive configuration arrangements indicate that an aft-tail controller concept will be superior to canard and tailless delta configurations. The latter configurations suffer controllability limitations that compromise the ability to achieve design goals for maneuverability and efficient supersonic cruise. Thrust vectoring was explored as a means of improving maneuver load factor capability. R.E.S.

N80-15155# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
WIND TUNNEL MEASUREMENTS AND ANALYSIS OF SOME UNUSUAL CONTROL SURFACES ON TWO SWEPT WING FIGHTER CONFIGURATIONS
D. Welte and S. Ehekircher *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 10 p (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Force measurements were made in a low speed and in a high speed wind tunnel with a 1:20 scale, 35 deg swept wing fighter configuration model. Surfaces which are deflected for longitudinal trim are: horizontal tail, leading- and trailing-edge flaps, a strake and a strake leading-edge flap. For lateral control

the following surfaces are deflected: ailerons, tperons, flaperons and a strake leading-edge flap. The main conclusions are: (1) trailing edge flaps are very useful to trim an unstable configuration and have minimum drag; (2) tiperons are very effective means for roll-yaw control up to very high angles of attack; and (3) differentially deflected leading edge flaps and a vortex fin, positioned on the wing upper surface, decrease the directional instability at high angles of attack. In addition, low speed tests were made with a new wing concept for a future fighter configuration, so called supersonic biplane, to investigate the effectiveness of the upper- and lower-wing trailing edge flaps. As supplement to the wind tunnel measurements some flight mechanical maneuver calculations were made to check the suitability and to compare the effectiveness of the different controls. R.E.S.

N80-15156# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
ROLL CONTROL BY DIGITALLY CONTROLLED SEGMENT SPOILERS
Klaus Jonas (Dornier-Werke G.m.b.H.), Horst Wuennenberg (Dornier-Werke G.m.b.H.), and Karl-Heinz Horstmann *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 8 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

To realize total wing span flaps for improving the maneuvering and landing performances of a combat aircraft the roll control has to be realized by spoilers. To overcome the nonlinearity and control reversal problems at low deflections, the continuously deflected spoiler is replaced by a certain set of digitally controlled single spoilers, which provide only three discrete deflections. It was found by simulator tests that by a proper combination of these segment spoilers it is possible to provide a roll control, which is judged as continuous by the pilot, with a relatively low number of single spoilers. Wind tunnel programs were performed to investigate system efficiency and aerodynamic effectiveness. Several roll spoiler configurations were tested in two and three dimensional configurations with and without landing flaps at different spanwise positions, spoiler deflections and -spans. It is shown that the effectiveness related to the deflection is linear for flaps-up and highly nonlinear for flaps-down configurations. The spoiler span is of no more influence at a certain value and the optimum spanwise location is about 0.8 of the semispan. Furthermore the effectiveness and the influence on lift and pitching moment for a possible test aircraft are shown. The practical application within an intended flight test program is discussed. R.E.S.

N80-15157# Boeing Aerospace Co., Seattle, Wash.
THE YC-14 UPPER SURFACE BLOWN FLAP: A UNIQUE CONTROL SURFACE
Alan H. Lee *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 8 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The application of powered-lift technology applied to the Boeing YC-14 is assessed. The YC-14 can be controlled during short takeoff landings using conventional pilot techniques. That capability stems from the use of its upper surface blown (USB) flaps as control surfaces. The USB flaps are used to help control aircraft lift and airspeed. They are positioned automatically by the flight control system to eliminate undesired lift changes caused by thrust changes or external disturbances and to work with the autothrottle to attain and hold a selected airspeed. The aerodynamic and physical characteristics of USB flaps are described. R.E.S.

N80-15158# Northrop Corp., Los Angeles, Calif.
FLAPERON CONTROL: THE VERSATILE SURFACE FOR FIGHTER AIRCRAFT
John F. Moynes and Wallace E. Nelson, Jr. *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 18 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The versatility of a flaperon is presented for roll performance and for several longitudinal active control modes. Particular emphasis is given to the advantages of a segmented flaperon over a full span for a YF-17 type aircraft. The areas of ride smoothing, direct lift, pitch pointing, vertical flight path control and flight control system reconfiguration are addressed for the active longitudinal control modes. The effect of flaperon pitching moment on the implementation of these modes is discussed. Author

N80-15159# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AFFDL EXPERIENCE IN ACTIVE CONTROL TECHNOLOGY
Robert P. Johannes and Robert A. Whitmoyer *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 20 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The evolution of active control technology (ACT) from the viewpoint of the Air Force Flight Dynamics Laboratory (AFFDL) is presented. Emphasis is placed on the aerodynamic control forces necessary to exploit ACT and in describing AFFDL development programs which merge these two disciplines and transition technology into operational flight equipment. Specific ACT programs described are: (1) the LAMS program; (2) the CCV B-52 program; (3) the SFCS F-4 program; (4) the CCV/PACT F-4 programs; (5) the Variable Stability NT-33 program; (6) the CCV YF-16 program; (7) the A-7D Digital Multimode program; (8) the IFFC I/FIREFLY III program; and (9) the AFTI-16 program. Experiences indicating areas of need for extension of fluid dynamics technology are also discussed. M.M.M.

N80-15160*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CONTROL CONSIDERATIONS FOR CCV FIGHTERS AT HIGH ANGLES OF ATTACK
Luat T. Nguyen, William P. Gilbert, and Sue B. Grafton *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 10 p ref (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01 CSCL 01C

Wind tunnel and piloted simulation studies were conducted to investigate the potential high angle of attack control problems that are introduced by the use of the CCV concept of relaxed static pitch stability (RSS) on fighter aircraft. A conventional wing/aft tail design incorporating modest levels of static instability and a close-coupled canard/wing design exhibiting very high levels of instability was investigated. Two types of high angle of attack control problems can result from the use of RSS: pitch departures caused by coupling and deep stall trim. Avoidance of these problems requires that the airplane have sufficient nose-down pitch control at high angles of attack. The effectiveness of several pitch control configurations were investigated including conventional aft-mounted stabilators, wing-mounted elevators, canard-mounted flaps, and all-moveable canards. Varying the incidence of the canards was the most effective scheme; however, very large deflections may be required on highly unstable configurations to prevent pitch departure without sacrificing roll performance and to avoid deep stall trim. For situations where the high angle of attack pitch control requirement is not met, control laws were developed to inhibit the departure and to allow deep stall recovery. However, these schemes involve limiting airplane roll capability and therefore can potentially compromise maneuverability. M.M.M.

N80-15161# British Aerospace Aircraft Group, Brough (England).
FIN DESIGN WITH ACT IN THE PRESENCE OF STRAKES
D. J. Walker *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 6 p (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Wind tunnel tests on a combat aircraft model are reported in which the effect of fin size and various types of fin controls were investigated. It was shown that a rudder (rather than an all moving fin) using active control technology is probably the best solution for incidences of up to about 50 deg. Also the use of such a system would allow a 20% reduction in the size of the basic fin. M.M.M.

N80-15162# McDonnell Aircraft Co., St. Louis, Mo.
CONTROL INTEGRATION TECHNOLOGY IMPACT
Charles A. Scolatti *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 6 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

Some of the essential elements of an integrated technology development program are presented. The integrated flight and fire control system programs, called IFFC I/FIREFLY III, is used as an example. The operational relevance of the example is discussed. The major problems in air-to-ground attack, and the introduction of maneuvering weapon delivery (with IFFC mechanization required to achieve bombing solutions), are covered. The impact of this IFFC technology, and its extension on other areas of technology, such as aerodynamics, is indicated. M.M.M.

N80-15163# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

DIRECT SIDE FORCE AND DRAG CONTROL WITH THE AID OF PYLON SPLIT FLAPS

Peter Esch and Horst Wuennenberg *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 9 p refs (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01

Two configurations of split flaps are examined, a long one with small deflections and a short one with large deflections. The short one led to the same effectiveness at reduced values of hinge moments and cross coupling effects. Due to high interference effects it was not possible to get the effects of all flaps by superposition of the single flap results. The angle of attack, the landing flap setting and the lateral projection area of the external stores have a significant influence on the effectiveness whereas the Mach number is less important. The examination of the wind tunnel results led to the necessary control laws for the operation of the flaps and the compensation equipment. The flight test program with an Alpha Jet preproduction aircraft is expected to start in 1980. M.M.M.

N80-15164*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CONTROL OF FOREBODY THREE-DIMENSIONAL FLOW SEPARATIONS

David J. Peake and F. Kevin Owen (Owen Intern., Inc., Palo Alto, Calif.) *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 49 p refs (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01 CSCL 01C

The development of the turbulent symmetric and asymmetric vortex flow about the lee side of a 5 deg semiangle conical forebody at high relative incidence was investigated. The cone was immersed in a Mach 0.6 airstream at a Reynolds number of 13.5 x 10 to the 6th power based on the 1.4 m axial length of the cone. Small amounts of air injected normally or tangentially to the cone surface, but on one side of the leeward meridian and beneath the vortex farthest from the wall, were effective in biasing the asymmetry. With this reorientation of the forebody vortices, the amplitude of the side force could be reduced to the point where its direction was reversed. This phenomenon was obtained either by changing the blowing rate at constant incidence or by changing incidence at constant blowing rate. Normal injection appeared more effective than tangential injection. The contrarotating vortices in the penetrating jet flow were of opposite hand to the rotational directions of the forebody vortices. A distinctively organized and stable flow structure emerged with the jet vortices positioned above the forebody vortices. K.L.

N80-15165# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

IN-FLIGHT MEASURED CHARACTERISTICS OF COMBINED FLAP-SPOILER DIRECT LIFT CONTROLS

O. Rix and D. Hanke *In* AGARD Aerodyn. characteristics of Controls Sep. 1979 22 p refs (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01

The influence of direct lift control on longitudinal aircraft dynamics and the requirements for the characteristics of direct lift controls for large transport aircraft in the landing approach phase are discussed. The characteristics of flaps, spoilers, and the influence of surface rate on aircraft behavior are also described. Flight tests were carried out with the DFVLR HFB 320 In-Flight Simulator to determine in-flight flap and spoiler characteristics and the characteristics of simultaneously deflected flaps and spoilers as a DLC device. The results show that flap and spoiler characteristics can be described by linear models for flap and spoiler inputs up to + or - 10 deg and + or - 30 deg, respectively, and relatively high surface rates of 10 deg/sec and 62 deg/sec. In addition, combined flap-spoiler deflections show no nonlinear or unsteady effects and the aircraft response is described by simple linear modelling. The spoiler derivatives valid for combined flap-spoiler deflections are identified. K.L.

N80-15166# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

WIND TUNNEL INVESTIGATION OF CONTROLS FOR DF ON A FIGHTER-TYPE CONFIGURATION OF HIGHER ANGLES OF ATTACK

Wolfgang Sonnleitner *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 11 p refs (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01

Stability and control characteristics of a fighter-type model were investigated at incidences up to 40 deg. Isolated and combined effects of different control shapes and control in different positions were demonstrated. K.L.

N80-15167# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

PROBLEMS OF UNSTEADY AERODYNAMICS RAISED BY THE USE OF CONTROL SURFACES AS ACTIVE CONTROLS [PROBLEMES D'AERODYNAMIQUE INSTATIONNAIRE POSES PAR L'UTILISATION DES GOUVERNES DANS LE CONTROLE ACTIF]

Roger Destuynder *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 17 p refs In FRENCH; ENGLISH summary (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01

The unsteady aerodynamic forces created by spoilers or auxiliary surfaces are investigated. Control problems concerning turbulence, gust control, and flutter phenomena are studied considering both subcritical and supercritical flows. Theoretical and mixed methods based on corrections defined after wind tunnel tests are applied. K.L.

N80-15168# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

UNSTEADY EFFECTS OF A CONTROL SURFACE IN TWO DIMENSIONAL, SUBSONIC AND TRANSONIC FLOW [EFFETS INSTATIONNAIRES D'UNE GOUVERNE EN ECOULEMENT BIDIMENSIONNEL SUBSONIQUE ET TRANSSONIQUE]

Richard Grenon, Andre Desopper, and Jacques Sides *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 14 p refs In FRENCH; ENGLISH summary (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01

The unsteady effects of an oscillating surface are studied. The experimental results of steady and unsteady pressure measurements carried out in subsonic and transonic flow on a 16% relative thickness supercritical airfoil, equipped with a trailing edge flap, are compared with those obtained by various methods of steady and unsteady inviscid flow calculations. Calculation results are presented in which viscous effects have been taken into account, for both steady and unsteady flows. K.L.

N80-15169# Royal Aircraft Establishment, Bedford (England). Structures Dept.

AERODYNAMIC CHARACTERISTICS OF MOVING TRAILING-EDGE CONTROLS AT SUBSONIC AND TRANSONIC SPEEDS

D. G. Mabey, D. M. McOwat, and B. L. Welsh *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 26 p refs (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01

Oscillatory pressures calculated and measured at high subsonic speeds for a swept back wing of aspect ratio 6 with a part span trailing edge flap were compared. The flap was driven at frequencies of 1 Hz (quasi-steady) and 90 Hz at Mach numbers from 0.40 to 0.95 with both fixed and free transition over a range of Reynolds numbers from 1 million to 4 million. The measured oscillatory pressures depended strongly on the boundary layer displacement thickness at the hinge line.

Extrapolation from model to full scale required great care. In subsonic flow, tests with free transition gave the thinnest turbulent boundary layer at the hinge line and come nearest to full scale. At transonic speeds, transition was fixed at a safe distance upstream of the most forward excursion of the shock wave to obtain results appropriate to higher Reynolds number. Tests with flap driven simultaneously at two frequencies (90 Hz and 131 Hz) at subsonic and transonic speeds produced the same oscillatory pressures at 131 Hz as when driven independently. The principle of superposition applies, at least for small amplitude motions with attached flows. R.C.T.

N80-15170# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.

UNSTEADY AERODYNAMICS OF TWO-DIMENSIONAL SPOILERS AT LOW SPEEDS

S. R. Siddalingappa and G. J. Hancock *In* AGARD Aerodynam. Characteristics of Controls Sep. 1979 13 p refs (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01

Complementary aspects of spoiler behavior are reviewed. The emphasis is on the understanding of the local flow about a spoiler. A two dimensional spoiler on the floor of a small blower tunnel (solid floor, and side walls but open at the top) was investigated. Steady pressures were measured along the tunnel floor for various steady spoiler angles and gap sizes between the bottom of the spoiler and the tunnel floor. Transient pressures were recorded following sudden changes in spoiler angle and for oscillating spoilers. A two dimensional spoiler attached to a two dimensional airfoil was investigated. The manner in which the spoiler affects the overall pressure distribution on the airfoil plus spoiler combination was emphasized. Both the airfoil and the spoiler were pressure plotted. The results of steady pressures, transient pressures following rapid and slower ramp changes in spoiler angle, and transient pressures when the spoiler is moving in simple harmonic motion are included. R.C.T.

N80-15171# Rome Univ. (Italy). School of Aerospace Engineering.

TRAJECTORY BEHAVIOUR OF A CONTROL CONFIGURATED AIRCRAFT SUBJECTED TO RANDOM DISTURBANCES

Achille Danesi, Scott Smolka (Boston Univ.), and Francesco Borrini *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 17 p refs (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01

The longitudinal behavior of a Boeing V-747 aircraft with some of its original aerodynamic effectors operating as active controllers in addition to the conventional elevators were studied. The ailerons were collectively used as outboard active flaps and the inboard section of the high lift triple slotted flaps was employed as inboard active flaps. The flight control system structure was implemented as an optimal model following system in which the optimal feedback gains were computed to minimize the integral performance index. Errors in dynamical response, in wing root bending moment, and in aerodynamic drag computed as deviations from the same quantities related to a specified model responding satisfactorily to disturbances with zero increments in wing root bending moment and aerodynamic drag in flight maneuver at given load factor, were considered. At the same time the minimum effectors activity was included as a design objective. A lighter wing structure was realized as the result of wing loads reduction and further weight saving (reduced tail size) was obtained by taking advantage of the beneficial effect of the active controller activity in reducing the elevator deflections required in the pull up maneuver. R.C.T.

N80-15172# Northrop Corp., Hawthorne, Calif. Aircraft Group.

FOREBODY VORTEX BLOWING: A NOVEL CONTROL CONCEPT TO ENHANCE DEPARTURE/SPIN RECOVERY CHARACTERISTICS OF FIGHTER AND TRAINER AIRCRAFT

Andrew M. Skow, William A. Moore, and Dale J. Lorincz *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 17 p refs (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01

Active blowing concepts which control the asymmetric orientation of the vortex system emanating from an aircraft forebody at high angles of attack are described. The side force generated by the asymmetric nature of the vortices was utilized. The choice between these two preferred positions was influenced strongly by very small geometric imperfections in an otherwise symmetric model and by small asymmetries in the upstream flow such as are caused by flow angularity or turbulent eddies in the free stream. The magnitude of the side force was very large due to the fluid amplification afforded by the vortex growth. The results of water tunnel flow visualization studies and a wind tunnel test program are presented which bear out this assumption and show that tangential blowing can effectively alter the forebody vortex system at angles of attack between 25 and 55 deg, and can generate yawing moments comparable to those produced by a conventional rudder at low angles of attack. The results of a six deg of freedom digital simulation are presented which show that this concept can substantially enhance departure recovery characteristics and could have potential as a departure inhibitor for some aircraft. The results of a preliminary system design indicate that such a system could be applied to aircraft. R.C.T.

N80-15173# Nielsen Engineering and Research, Inc., Mountain View, Calif.

NONLINEAR AERODYNAMICS OF ALL-MOVABLE CONTROLS

Charles A. Smith and Jack N. Nielsen *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 20 p refs (For primary document see N80-15149 06-08)

(Contract N00014-74-C-0050)

Avail: NTIS HC A22/MF A01

The nonlinear effects and their consequences on control effectiveness are described. Both independent control effectiveness (e.g., pitch control) as well as control cross coupling (e.g., pitch control in the presence of yaw control) are discussed. It is shown that, at sufficiently high angles of attack, the presence of these nonlinearities can completely dominate control effectiveness. The current status of techniques to predict control effects using both analytical and data correlation techniques are reviewed. R.C.T.

N80-15174# Ruhr Univ., Bochum (West Germany).

ON THE EFFECT OF WING WAKE ON TAIL CHARACTERISTICS

K. Gersten and D. Glueck *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 8 p refs (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01

A nonlinear theory was developed to calculate lift and moment forces for airfoils in a two dimensional flow field. The oncoming velocity distribution is approximated by a series of step functions which results in a flow field composed of a number of potential flow fields. The potential flow fields are matched properly at several dividing streamlines where the total pressure changes discontinuously. The solution of the problem is determined by using vortex distributions on both the contour of the airfoil and the dividing streamlines. A special approach makes it possible to calculate the flow field when one of the dividing streamlines merges with the profile. A comparison between theoretical and experimental results for the aerodynamic characteristics of a tail unit placed in the wake of a wing is presented. A prediction method for the tail characteristics at high angles of attack (super stall) is discussed. A.W.H.

N80-15175# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

AERODYNAMIC INTERACTION ON A CLOSE-COUPLED CANARD WING CONFIGURATION [INTERACTION AERODYNAMIQUE ENTRE UN CANARD PROCHE ET UNE VOILURE]

Yves Brocard and Volker Schmitt *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 11 p refs In FRENCH; ENGLISH summary (For primary document see N80-15149 06-08)

Avail: NTIS HC A22/MF A01

Half model tests performed on a close coupled canard wing configuration in a low speed, pressurized wind tunnel are discussed. Results are presented in terms of longitudinal aerodynamic characteristics and pressure distribution on the main

wing. The effects of canard deflection and of Reynolds number variation are investigated. Surface oil flow pattern on the wind tunnel model and water tunnel visualization on a smaller model are examined. Comparisons between the experimental results and theoretical predictions are presented. A.W.H.

N80-15176# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.
ON THE EFFECTS OF GAPS ON CONTROL SURFACE CHARACTERISTICS
C. Michael and G. J. Hancock. *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 13 p ref (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

A two dimensional airfoil comprising an elliptic nose, parallel section of 5% t/c ratio, and a 20% trailing edge control surface was investigated at low speeds. Three different geometries of the rear of the main airfoil were investigated. Gaps were created by moving the control surface aft of the main airfoil. Extensive pressure plotting is presented for the above range of gaps and control surface angular deflections up to 8 degrees and a range of measurements of mean boundary layer profiles in the neighborhood of the gap are discussed. The variations of the overall lift coefficient with control angle and gap size for the three geometries are reported. A.W.H.

N80-15177# MATRA Service Aerodynamique, Velizy-Villacoublay (France).
AERODYNAMIC STUDY OF MISSILE CONTROL SURFACES [ETUDE AERODYNAMIQUE DES GOUVERNES DE MISSILE]
J. Perinelle and L. Mifsud. *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 19 p In FRENCH; ENGLISH summary (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The basic characteristics of low aspect ratio surfaces for missile control surfaces are reviewed. After a review of the different aerodynamic configurations and their implications on performances, the aerodynamic of canard missiles control surfaces are discussed in relation to the maximum lift at high angles of attack and the hinge moment. A.W.H.

N80-15178# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany). Commercial Aircraft Div.
SOME INVESTIGATIONS CONCERNING THE EFFECTS OF GAPS AND VORTEX GENERATORS ON ELEVATOR EFFICIENCY AND OF LANDING FLAP SWEEP ON AERODYNAMIC CHARACTERISTICS
Herbert Neppert and Richard Sanderson. *In* AGARD Aerodyn. Characteristics of Controls Sep. 1979 12 p refs (For primary document see N80-15149 06-08)
Avail: NTIS HC A22/MF A01

The effect of gaps and vortex generators on elevator effectiveness and drag is examined. The effect of single rudder deflection on the effectiveness of a split rudder is discussed. Wind tunnel results and proposals for improving the aerodynamic characteristics of a tailplane by means of a reduction in the sweep on the landing flap hinge line are described. A.W.H.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-15179*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LOX/GOX MECHANICAL IMPACT TESTER ASSESSMENT
J. W. Bransford (NASA, Marshall Space Flight Center), C. J. Bryan, G. W. Frye (NASA, Johnson Space Center), and S. L. Stohler (Rocketdyne, Canoga Park, Calif.) Feb. 1980 103 p refs
(NASA-TM-74106) Avail: NTIS HC A06/MF A01 CSCL 14B

The performances of three existing high pressure oxygen mechanical impact test systems were tested at two different test sites. The systems from one test site were fabricated from the same design drawing, whereas the system tested at the other site was of different design. Energy delivered to the test sample for each test system was evaluated and compared. Results were compared to the reaction rates obtained. R.C.T.

N80-15180# Air Force Human Resources Lab., Brooks AFB, Tex.
EFFECTS OF VARYING VISUAL DISPLAY CHARACTERISTICS OF THE T-4G, A T-37 FLIGHT SIMULATOR Final Report, Aug. 1974 - Dec. 1977
Robert R. Woodruff Jun. 1979 17 p refs
(AF Proj. 1123)
(AD-A071410; AFHRL-TR-79-17) Avail: NTIS HC A02/MF A01 CSCL 05/9

Two experiments were conducted using the T-4G, a T-37 flight simulator, to investigate the benefit to simulation of visual displays which have color or are collimated. Thirty-two Air Force undergraduate pilots learned approach and landing in the T-4G using either black and white or colored imagery. Thirty-eight instructor pilots performed approach and landing with visual displays that had collimation or reduced collimation. No statistically significant differences were found in either experiment. Power analysis shows that each of these experiments would have detected a practically significant difference, if one existed, with a probability of more than .75. There are no psychophysical reasons to use either color or collimation. User acceptance is another thing, and if color and collimation improve acceptance, they should be used. GRA

N80-15181# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
CLIMATIC CHAMBER TESTING AIRCRAFT, ENGINES ARMAMENT AND AVIONICS; TEST OPERATIONS PROCEDURE Final Report
31 Aug. 1979 35 p Supersedes MTP-7-3-521
(AD-A074049; TOP-7-3-521; MTP-7-3-521) Avail: NTIS HC A03/MF A01 CSCL 01/3

This document provides information, guidance and methodology for planning and conducting an environmental climatic chamber developmental test of aviation materiel. Environmental climatic chamber developmental testing in general, determines the degree to which aviation materiel meets the developmental requirements of the US Army Materiel Needs (MN) documents, when subjected to the environmental conditions developed in the climatic chamber. GRA

N80-15182# Avco-Everett Research Lab., Mass.
DESIGN STUDY FOR ATA VACUUM SYSTEM APERTURE
S. Hibbs 26 Jul. 1979 24 p refs
(Contract W-7405-eng-48)
(UCRL-15050) Avail: NTIS HC A02/MF A01

A vacuum system aperture for the advanced test accelerator is analyzed. An axial aerowindow, a suction type aerowindow, and a combination suction/axial aerowindow are examined. The combination suction/axial aerowindow is recommended due to the estimated leakage rate and the projected cost. DOE

N80-15183# General Applied Science Labs., Inc., Westbury, N. Y.
CONCEPTUAL DESIGN AND PERFORMANCE ESTIMATES FOR A SUPERSONIC AERODYNAMIC WINDOW FOR THE ATA VACUUM SYSTEM APERTURE Final Report
J. I. Erdos Jun. 1979 39 p refs
(Contract W-7405-eng-48)
(UCRL-15051) Avail: NTIS HC A03/MF A01

The design of an aerodynamic window for the aperture in a system of interconnecting cavities is discussed. Two types of windows are considered and evaluated for the system. They are a supersonic jet operating transverse to the aperture axis and a supersonic jet operating coaxially about the aperture. A.W.H.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

N80-15184# Committee on Science and Technology (U. S. House).
INTERNATIONAL SPACE ACTIVITIES, 1979
Washington GPO 1979 250 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 5-6 Sep. 1979
(GPO-53-451) Avail: Subcom. on Space Sci. and Applications
International space activities in the year 1979 are reviewed. Among the subjects discussed are broadcasting satellite service, solar power satellites, radio astronomy, technology development, and future directions in space research. A.W.H.

N80-15185*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SIMPLE COMPUTATIONS FOR NEAR-OPTIMUM ASCENT AND ABORT MANEUVER TARGETS AND DEORBIT IGNITION TIME
R. Leroy McHenry Jan. 1980 24 p refs
(NASA-TM-80850; JSC-16318; Rept-80-FM-3) Avail: NTIS HC A02/MF A01 CSCL 22A
Closed-form solutions are presented for a two-burn orbit insertion, AOA, and ATO maneuver targets, and for time of ignition of a one-burn deorbit. Based on the assumption that the orbits involved deviate only to the first order about a reference circular orbit, these solutions are nearly fuel-minimum. They are expressed in terms of linear terminal velocity constraint shuttle guidance targets and, thus, are readily applicable to both ground and onboard software use. In addition to potential application to real-time targeting, the equations may be used as a mission design aid in preliminary definition of target loads and definition of abort mode boundaries. A.R.H.

N80-15186*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED GEOSYNCHRONOUS MISSION REQUIREMENTS AND SYSTEMS ANALYSIS STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Ron E. Boyland, Stanley W. Sherman, and Henry W. Morfin 7 Nov. 1979 42 p refs 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160429) Avail: NTIS HC A03/MF A01 CSCL 22A
The crew capsule of the MOTV was studied with emphasis on crew accommodations, crew capsule functional requirements, subsystem interface definition between crew module and propulsion module, and man rating requirements. Competing mission modes were studied covering a wide range of propulsion concepts. These included one stage, one and one half stage, and two stage concepts using either the standard STS or an augmented STS. Several deorbit concepts were considered, including all propulsive modes, direct re-entry, and aeromaneuvering skip in skip out in the upper reaches of Earth's atmosphere. A five year plan covering costs, schedules, and critical technology issues is discussed. A.W.H.

N80-15187*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED ORBITAL TRANSFER VEHICLE (MOTV). VOLUME 2: MISSION HANDBOOK Final Report
Ron E. Boyland, Stanely W. Sherman, and Henry W. Morfin 7 Nov. 1979 138 p 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160430) Avail: NTIS HC A03/MF A01 CSCL 22A
The use of the manned orbit transfer vehicle (MOTV) for support of future space missions is defined. Some 20 generic missions are defined each representative of the types of missions expected to be flown in the future. These include the service and update of communications satellites, emergency repair of surveillance satellites, and passenger transport of a six man crew rotation/resupply service to a deep space command post. The propulsive and functional capabilities required of the MOTV to support a particular mission are described and data to enable the user to determine the number of STS flights needed to support the mission, mission peculiar equipment requirements, parametrics on mission phasing and requirements, ground and flight support requirements, recovery considerations, and IVA/EVA trade analysis are presented. A.W.H.

N80-15188*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED ORBITAL TRANSFER VEHICLE (MOTV). VOLUME 3: PROGRAM REQUIREMENTS DOCUMENTS Final Report
Ron E. Boyland, Stanley W. Sherman, and Henry W. Morfin 7 Nov. 1979 65 p 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160431) Avail: NTIS HC A04/MF A01 CSCL 22A
The requirements for geosynchronous orbit capability using the manned orbit transfer vehicle (MOTV) are defined. The program requirements, the mission requirements, and the system and subsystem requirements for the MOTV are discussed. The mission requirements include a geosynchronous Earth orbit vehicle for the construction, servicing, repair and operation of communications, solar power, and Earth observation satellites. A.W.H.

N80-15189*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED ORBITAL TRANSFER VEHICLE (MOTV). VOLUME 4: SUPPORTING ANALYSIS Final Report
Ron. E. Boyland, Stanley W. Sherman, and Henry W. Morfin 7 Nov. 1979 106 p 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160432) Avail: NTIS HC A06/MF A01 CSCL 22A
Generic missions were defined to enable potential users to determine the parameters for suggested user projects. Mission modes were identified for providing operation, interfaces, performance, and cost data for studying payloads. Safety requirements for emergencies during various phases of the mission are considered with emphasis on radiation hazards. F.O.S.

N80-15190*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED ORBITAL TRANSFER VEHICLE (MOTV). VOLUME 5: TURNAROUND ANALYSIS Final Report
Ron E. Boyland, Stanley W. Sherman, and Henry W. Morfin 7 Nov. 1979 130 p 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160433) Avail: NTIS HC A07/MF A01 CSCL 22A
The development of a low-cost reliable turnaround process to employ the MOTV in enhancing the utilization of the geosynchronous space region is analyzed. It is indicated that a routine effective turnaround/maintenance plan must make maximum use of flight data for maintenance planning, a high degree of test automation, and MOTV maintainability features in order to minimize tests, facilitate repair, and reduce manpower requirements. An effective turnaround plan provides a payback of reduced risks. F.O.S.

N80-15191*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED ORBITAL TRANSFER VEHICLE (MOTV). VOLUME 6: FIVE YEAR PROGRAM PLAN Final Report
Ron E. Boyland, Stanley W. Sherman, and Henry W. Morfin 7 Nov. 1979 36 p 6 Vol.
(Contract NAS9-15779)
(NASA-CR-160434) Avail: NTIS HC A03/MF A01 CSCL 22A
The five year program plan for the manned orbit transfer vehicle (MOTV) is presented. The planning, schedules, cost estimates, and supporting data (objectives, constraints, assumptions, etc.) associated with the development of the MOTV are discussed. The plan, in addition to the above material, identifies the supporting research and technology required to resolve issues critical to MOTV development. A.W.H.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-15192# Naval Surface Weapons Center, Dahlgren, Va.
PERTURBATIONS IN PERIGEE AND ECCENTRICITY AT

THE CRITICAL INCLINATION Final Report
Claus Oesterwinter Dec. 1978 29 p refs
(AD-A073975; NSWC/DL-TR-3724) Avail: NTIS
HC A03/MF A01 CSCL 22/3

A cluster of three satellites showed large, unpredicted orbital perturbations shortly after launch. There was immediate concern for the success of its mission which depends on the stability of the cluster geometry. The Naval Surface Weapons Center found the zonal harmonics of degree five and seven to cause most of the observed perturbations. Subsequently, the three orbits were computed for the time frame June 1976 to July 1984. It was also shown that the cluster configuration remains unaffected by the large orbital perturbations, and the mission appears safe. GRA

N80-15193# Naval Surface Weapons Center, Dahlgren, Va.
***COMPARISON OF C-BAND RADAR AND DOPPLER GEOCEIVER ACCURACIES IN ORBIT DETERMINATION* Final Report**
Carol G. Branch Nov. 1978 22 p refs
(AD-A073877; NSWC/DL-TR-3719) Avail: NTIS
HC A02/MF A01 CSCL 22/3

A study is made herein of the relative consistency of C-band and Doppler station navigations with respect to a Doppler-derived orbit. The procedure, results, error analyses, and accuracy criteria are included. It is concluded that C-band radar tracking data are not an adequate substitute for Doppler geoceiver data in computing orbits of satellites when precise altitudes are required for satellite altimeter applications. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters, and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-15194*# Bendix Corp., Teterboro, N. J. Guidance Systems Div.
SPACE CONSTRUCTION BASE CONTROL SYSTEM Final Report
R. F. Kaczynski 1 Sep. 1979 479 p refs
(Contract NASB-32660)
(NASA-CR-161353) Avail: NTIS HC A21/MF A01 CSCL 22B

Several approaches for an attitude control system are studied and developed for a large space construction base that is structurally flexible. Digital simulations were obtained using the following techniques: (1) the multivariable Nyquist array method combined with closed loop pole allocation, (2) the linear quadratic regulator method. Equations for the three-axis simulation using the multilevel control method were generated and are presented. Several alternate control appraches are also described. A technique is demonstrated for obtaining the dynamic structural properties of a vehicle which is constructed of two or more submodules of known dynamic characteristics. Author

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-15195*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY
Nov. 1979 39 p Prepared in cooperation with General Elec. Co., Fairfield, Conn.; Grumman Aerospace Corp., N. Y.; Little (Arthur D.), Inc., Cambridge, Mass.; TRW, Inc., Cleveland, Ohio; Brown and Root, Inc., Houston, Tex.
(Contract NAS9-15636)
(NASA-CR-160442; D180-25461-1) Avail: NTIS
HC A03/MF A01 CSCL 11B

Configuration concepts, option sizes, and systems definitions study design evolutions are reviewed. The main features of the present reference design silicon solar cell solar power satellite are described, as well as the provisions for space construction and support systems. The principal study accomplishments and conclusions are summarized according to the following tasks: (1) baseline critique; (2) construction and maintenance; (3) industrial complex needs, cost estimates, and production capacity; (4) launch complex requirements at KSC or at an offshore facility; (5) integration of the SPS/ground power network; (6) technology advancement and development; (7) costs and schedules; and (8) exploratory technology: laser annealing of solar cells degraded by proton irradiation, and a fiber-optic phase distribution link at 980 MHz. A.R.H.

N80-15196# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIFFERENTIAL ORBIT CORRECTION FOR NEAR-STATIONARY ARTIFICIAL SATELLITES
Laurence G. Taff and John M. Sorvari 17 Jul. 1979 35 p refs
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A074231; TN-1979-38; ESD-TR-79-184) Avail: NTIS
HC A03/MF A01 CSCL 22/3

This report presents a new concept for the differential correction of orbits. It is developed in detail for near-stationary artificial satellites. For these satellites a few observations over a short time interval allows the reacquisition of the satellite an hour later. Moreover, with only slightly more data points over a slightly longer time interval it is capable of producing an excellent set of orbital elements. The technique is self-starting and does not use any of the classical initial orbit determination procedures. It can be used by a radar or extended to include angular velocity data. Its success appears to be based on the ability to find a coordinate system in which the object's motion is nearly stationary, and the extensive use of analytical procedures. Extensions of the theory to include all first-order perturbations and to all orbital types are possible. GRA

N80-15197# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
HIGH SPEED FUNCTION GENERATION FOR RESEARCH AND PROJECT SUPPORT
Charles L. Lewis, Gary M. Griner, and Larry H. Hazel Jun. 1979 34 p refs
(AD-A073973; DRDMI-T-79-66) Avail: NTIS
HC A03/MF A01 CSCL 09/2

Since 1972, the US Army Missile Research and Development Command (MIRADCOM) has maintained and operated a real-time hardware-in-the-loop (HWIL) homing missile simulation at Redstone Arsenal, Alabama. Because of the need for a detailed, accurate simulation, and to support the US Army Modular Missile research program and other advanced missile research, a decision was made to upgrade the HWIL simulation by adding a special purpose digital processor. The processor selected was the Applied Dynamics, Inc., AD 10. This report described the work performed to program the AD 10 and modify the existing simulation for the Homing and Laser Simulation Facility (HALS). GRA

N80-15198# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
***NUCLEAR POWERED SATELLITE STUDIES* Annual Progress Report, 1 Jul. 1978 - 30 Jun. 1979**
M. H. Kaplan Jun. 1979 71 p refs
(Contract EY-76-S-02-4045)
(COO-4045-4) Avail: NTIS HC A04/MF A01

The development of tools and inputs to be used in evaluating applications of nuclear power to satellites is discussed. Considerations include new constraints of the space transportation system, projected missions through the 1990's, and technology advances in nuclear power supplies. The topics addressed include satellite simulation software, GPHS reentry stability, nuclear

reactor technology, ion engine technology, and orbit considerations. A.W.H.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-15199*# Pennwalt Corp., King of Prussia, Pa. Technical Div.

DEVELOPMENT OF A SPECIAL PURPOSE SPACECRAFT INTERIOR COATING, PHASE 3

H. D. Gillman and P. Nannelli Apr. 1979 15 p refs

(Contract NAS9-14403)

(NASA-CR-160441) Avail: NTIS HC A02/MF A01 CSCL 22B

A variety of intumescent coatings based on a fluorocarbon latex resin modified with either an acrylic resin or an epoxy resin were prepared. Several intumescent systems were used for these studies including some based on ammonium polyphosphate and others based on sulfanilamide. The best coatings developed had a high concentration (60-70% by wt.) of intumescent additives and had to be applied thick, approximately 100 mils, in order to have adequate intumescent/fire protection properties. Author

N80-15200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONFIGURATION EFFECTS ON SATELLITE CHARGING RESPONSE

C. K. Purvis 1980 20 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA

(NASA-TM-81397; E-307) Avail: NTIS HC A02/MF A01 CSCL 22B

The response of various spacecraft configurations to a charging environment in sunlight was studied using the NASA Charging Analyzer Program code. The configuration features geometry, type of stabilization, and overall size. Results indicate that sunlight charging response is dominated by differential charging effects. Shaded insulation charges negatively result in the formation of potential barriers which suppress photoelectron emission from sunlit surfaces. Sunlight charging occurs relatively slowly; with 30 minutes of charging simulations, in none of the configurations modeled did the most negative surface cell reach half its equilibrium potential in eclipse. R.C.T.

N80-15201*# Old Dominion Univ. Research Foundation, Norfolk, Va.

CONTROL SYSTEMS DESIGN FOR LARGE FLEXIBLE SPACE STRUCTURES Final Report, 15 Nov. 1977 - 14 Jan. 1980

Suresh M. Joshi and A. S. Roberts, Jr. (Old Dominion Univ.) Jan. 1980 21 p refs

(Grant NsG-1473)

(NASA-CR-162582) Avail: NTIS HC A02/MF A01 CSCL 22B

Several approaches for the design of reduced-order linear-quadratic-Gaussian type controllers for large space structures were proposed and evaluated using a continuous model of a long free-free beam. Sufficient conditions were derived for the asymptotic stability with this type of controller. A finite-element model of a free-free-free-free square plate was obtained for use in control systems studies. A method was developed for optimal damping enhancement in large space structures. Author

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-15202*# Rocketdyne, Canoga Park, Calif.

LIQUID OXYGEN/LIQUID HYDROGEN AUXILIARY POWER SYSTEM THRUSTER INVESTIGATION Final Report, Oct. 1976 - Feb. 1979

E. E. Eberle and L. Kusak Dec. 1979 186 p refs

(Contract NAS3-20373)

(NASA-CR-159674; RI/RD79-217) Avail: NTIS HC A09/MF A01 CSCL 21H

The design, fabrication, and demonstration of a 111 newton (25 lb) thrust, integrated auxiliary propulsion system (IAPS) thruster for use with LH2/LO2 propellants is described. Hydrogen was supplied at a temperature range of 22 to 33 K (40 to 60 R), and oxygen from 89 to 122 K (160 to 220 R). The thruster was designed to operate in both pulse mode and steady-state modes for vehicle attitude control, space maneuvering, and as an abort backup in the event of failure of the main propulsion system. A dual-sleeve, tri-axial injection system was designed that utilizes a primary injector/combustor where 100 percent of the oxygen and 8 percent of the hydrogen is introduced; a secondary injector/combustor where 45 percent of the hydrogen is introduced to mix with the primary combustor gases; and a boundary layer injector that uses the remaining 45 percent of the hydrogen to cool the thrust throat/nozzle design. Hot-fire evaluation of this thruster with a BLC injection distance of 2.79 cm (1.10 in.) indicated that a specific impulse value of 390 sec can be attained using a coated molybdenum thrust chamber. Pulse mode tests indicated that a chamber pressure buildup to 90 percent thrust can be achieved in a time on the order of 48 msec. Some problems were encountered in achieving

ignition of each pulse during pulse trains. This was interpreted to indicate that a higher delivered spark energy level (> 100 mJ) would be required to maintain ignition reliability of the plasma torch ignition system under the extra 'cold' conditions resulting during pulsing. Author

N80-15203*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ADVANCED OXYGEN-HYDROCARBON ROCKET ENGINE STUDY Monthly Progress Report, 15 Oct. - 30 Nov. 1979
C. J. OBrien 10 Dec. 1979 31 p
(Contract NAS8-33452)
(NASA-CR-161350; MPR-33452M-1) Avail: NTIS HC A03/MF A01 CSCL 21H

A consistent engine system data base was generated for defining advantages and disadvantages, system performance and operating limits, engine parametric data, and technology requirements for candidate high pressure LO2/HC engine systems. Optimum LO2/HC engine power cycles were synthetized and representative conceptual engine design generated for a specified advanced surface to orbit transportation system. M.M.M.

N80-15204*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF GaAs AND Si SOLAR CELL ARRAYS FOR EARTH ORBITAL AND ORBIT TRANSFER MISSIONS
Kent D. Jeffries 1980 9 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81383; E-291) Avail: NTIS HC A02/MF A01 CSCL 21C

Silicon and gallium arsenide arrays were studied and compared for low earth orbit (LEI), geosynchronous orbit (GEO), and LEO to GEO electric propulsion orbit transfer missions. The sensitivities of total cost to parameters such as mission duration, array cost, cover glass thickness, and concentration ratio were determined along with cost tradeoffs between silicon and gallium arsenide arrays for selected mission classes. Results indicate that development of the technology for low cost, light weight concentrators should be increased and that cost reduction efforts for gallium arsenide cells be pursued. R.C.T.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N80-15205*# Clemson Univ., S.C. Dept. of Mechanical Engineering.
ANALYSIS OF A UNIDIRECTIONAL COMPOSITE CONTAINING BROKEN FIBERS AND MATRIX DAMAGE Annual Report
James G. George and Robert S. Gross Oct. 1979 36 p refs (Grant NsG-1297)
(NASA-CR-159185) Avail: NTIS HC A03/MF A01 CSCL 11D

An analytical solution is developed for the determination of the stresses and displacements in a unidirectional fiber-reinforced composite containing an arbitrary number of broken fibers as well as longitudinal yielding and splitting of the matrix. The solution is developed using a materials-modeling approach which is based on a shear-lag stress transfer mechanism. The equilibrium equation in the axial direction gives a pair of integral equations which are solved numerically. Excellent agreement is shown to exist between the solution and experimental results for notched unidirectional boron/aluminum laminates without splitting. For brittle matrix composites (i.e. epoxy) equally good results are indicated for both matrix yielding and splitting. For yielding without splitting the fracture strength depends on crack length while for large splitting it is crack length independent. Author

N80-15206# Northwestern Univ., Evanston, Ill.
DYNAMICS OF COMPOSITE MATERIALS AND ELASTIC STRUCTURAL ELEMENTS WITH VARIABLE DIMENSIONS Final Report, 15 Aug. 1978 - 20 Sep. 1979
S. Nemat-Nasser Sep. 1979 8 p refs
(Contract DAAG29-78-G-0149)
(AD-A074592; ARO-15872.2-E) Avail: NTIS HC A02/MF A01 CSCL 11/4

In this project effective methods have been sought for estimating bounds on eigenvalues and vibration characteristics of nonuniform rotor blades, composite plates, and other structural elements which consist of materials with nonuniformly varying properties. GRA

N80-15207# Stanford Univ., Calif. Applied Mechanics Div.
STEADY-STATE POINT-SOURCE EXCITATION OF A LAMINATED COMPOSITE Interim Report
G. S. Beaupre and G. Herrmann Jun. 1979 26 p refs
(Contract N00014-76-C-0054)
(AD-A074336; SU-DAM-79-3) Avail: NTIS HC A03/MF A01 CSCL 11/4

Steady-state periodic excitation at a point of an extended periodically laminated elastic composite is considered in anti-plane strain. The curves of constant phase are determined in the geometric optics approximation. The associated distribution of group velocity is also calculated. GRA

N80-15208# Oklahoma Univ., Norman. School of Aerospace Mechanical and Nuclear Engineering.
CLASSICAL ANALYSES OF LAMINATED BIMODULUS COMPOSITE-MATERIAL PLATES
Charles W. Bert Aug. 1979 42 p refs Supersedes AD-A072276
(Contract N00014-78-C-0647; NR Proj. 064-609)
(AD-A074125; OU-AMNE-79-10A; TR-4A; AD-A072276) Avail: NTIS HC A03/MF A01 CSCL 11/4

A differential-equation formulation is presented for the equations governing the small-deflection elastic behavior of thin plates laminated of anisotropic bimodulus materials (which have different elastic stiffnesses depending upon the sign of the fiber-direction strains). As a basis for comparative evaluation of a finite-element formulation presented in Technical Report No. 3 of the contract, exact closed-form solutions are presented for two cross-ply-laminated plate problems: (1) a freely supported rectangular plate subjected to a sinusoidally distributed normal pressure, and (2) a fully clamped elliptic plate subjected to uniform normal pressure. For the special case of isotropic bimodulus material, simplified approximate solutions are deduced from the exact ones. Good agreement is obtained among the two solutions presented here, as well as with numerical results existing in the literature for special cases and with the finite-element results. Also, for the first time a closed-form solution for a rectangular plate arbitrarily laminated of anisotropic ordinary (not bimodulus) material is presented. GRA

N80-15209# Washington Univ., St. Louis, Mo. Materials Research Lab.
FATIGUE FAILURE OF COMPOSITE LAMINATES Interim Report, May 1977 - Apr. 1978
Nhan Q. Nguyen and J. L. Kardos Wright-Patterson AFB, Ohio AFML Apr. 1979 36 p
(Contract F33615-77-C-5053; AF Proj. 2419)
(AD-A073899; AFML-TR-79-4035) Avail: NTIS HC A03/MF A01 CSCL 11/4

This program is to provide fatigue data on a graphite-epoxy composite. AS/3501-5A was selected as the test material. Unidirectional composites with 0 and 90 degree ply orientations were tested. Both static and fatigue strength were measured. Multidirectional laminates with + or - 45 and 02/90/+ or - 45 ply orientations were also tested. The fatigue data were analyzed using Weibull parameters. The frequency of testing was kept low in order to limit the temperature use below 5 C. More

extensive data will be generated and analyzed under this contract. GRA

N80-15210# Virginia Univ., Charlottesville. Dept. of Materials Science.
INVESTIGATION OF ELONGATION AND ITS RELATIONSHIP TO RESIDUAL STRESSES IN BORON FILAMENTS
Franklin E. Wawner, Jr., J. W. Eason, and Robert A. Johnson Sep. 1979 103 p refs
(Contract N00014-76-C-0694)
(AD-A074440; UVA/525322/MS79/102; TR-2) Avail: NTIS HC A06/MF A01 CSCL 11/6

Elongation in boron filament during fabrication was investigated and found to be as great as 16% under certain conditions. It was also found to obey a relatively simple empirical relationship which yielded effective activation energies. A model for the elongation was proposed, and a computer program was designed to simulate the deposition and elongation of boron on a tungsten wire substrate. Internal residual stress distribution of boron/tungsten filament were also generated by the computer program. Good agreement was found between the proposed model and experimental results. Negative elongation (contraction) of boron filament was observed during annealing and found to be dependent upon the concentration of oxygen present in the annealing atmosphere. The contraction was also found to be the result of void formation at the core-boron sheath interface. The contraction obeyed an empirical relationship, which represented an exponential decay toward equilibrium from a non-equilibrium state and an effective activation energy was determined for boron/tungsten filament. GRA

N80-15211# Los Alamos Scientific Lab., N. Mex.
PREPARATION OF UNIDIRECTIONAL FIBER REINFORCED TANTALUM CARBIDE COMPOSITES
L. R. Newkirk, R. E. Riley, H. Sheinberg, F. A. Valencia, and T. C. Wallace 1979 12 p refs Presented at the Intern. Conf. on Chem. Vapor Deposition, Los Angeles, 14 Oct. 1979 Sponsored in part by NSWC
(Contract W-7405-eng-36)
(LA-UR-79-951; CONF-791017-5) Avail: NTIS HC A02/MF A01

A process is described for uniformly infiltrating 3000 filament carbon yarn with Ta and subsequent densification by hot pressing. The Ta deposition rate is characterized as a function of deposition temperature, reactant flows, yarn pull rate, and coating chamber geometry for yarn pull rates from 2 to 50 m/h and Ta loadings from 40 to 350 wt % gain. Densification procedures for unidirectional pressings are described and data is presented which shows significant improvement in flexure strength over conventional TaC-C powder composites. DOE

N80-15212# California Univ., Livermore. Lawrence Livermore Lab.
FILAMENT WINDING EPOXY RESINS FOR ELEVATED TEMPERATURE SERVICE
J. A. Rinde, E. T. Mones, and H. A. Newey 9 Oct. 1978 10 p
(Contract W-7405-eng-48)
(UCRL-52577) Avail: NTIS HC A02/MF A01

Six epoxy resin systems suitable for wet filament winding of high-performance flywheels were formulated and evaluated. The resins were judged on five criteria: (1) low viscosity, (2) long gel time, (3) high glass transition temperature, (4) high tensile strength with high modulus, and (5) good retention of mechanical properties upon accelerated heat aging. From the results of mechanical and physical tests, resin 1 (Ciba 0510/RD-2/APCO 2330) is the best resin for the intended application. Resin 2 (Ciba 0510/Tonox 60-40) is the second choice; it offers a lower tensile strength and a larger loss in strength upon heat aging than resin 1 but has the highest glass transition temperature. DOE

N80-15213# California Univ., Livermore. Lawrence Livermore Lab.
CHARACTERISTICS OF THICK NON-PLANAR SiO2 COATINGS
S. F. Meyer and E. J. Hseih 11 Apr. 1979 13 p refs Presented at Intern. Conf. on Met. Coatings, San Diego, Calif., 23 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-81842; CONF-790442-15) Avail: NTIS HC A02/MF A01

A process was developed for making strong, smooth, thick SiO2 films on hemispherical Kovar mandrels of various sizes designed for multishell laser fusion targets. The surface finish obtainable with a 13 micron m thick coating on a 260 micron m dia. mandrel is approximately 30 nm peak-to-peak, with a few defects of roughly 0.3 micron m deep. The RF magnetron sputtered SiO2 films were dense and crystalline. DOE

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N80-15214# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
INFLUENCE OF GEOMETRIC AND KINEMATIC FACTORS ON COMBUSTION PERFORMANCE
C. Presser, Y. Goldman, and Y. Manheimer-Timnat Nov. 1978 78 p refs
(TAE-350) Avail: NTIS HC A05/MF A01

Factors effecting changes in the flame configuration are studied for swirl air/liquid fuel burners. The variation of fuel spray angle for providing a more uniform particle distribution, the effect of swirl impeded secondary air flow for enhancing secondary-air/fuel mixing, and the effect of combustion gas recirculation on fuel droplet evaporation which develops from the presence of a sudden expansion in the burner tunnel geometry are considered. It was shown that wider spray angles produce a more uniform air/fuel distribution throughout the diffusive combustion region with an apparent shortening and widening in flame shape. For increased swirl number, turbulent mixing is enhanced, thereby creating a flame whose ignition occurs closer to the burner and a seemingly shorter flame in the combustion chamber. It was concluded that the influence of these variables on the combustion process enhances the capability of controlling the flame shape and of utilizing combustion properties more effectively. M.M.M.

N80-15215*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
COMBUSTION NOISE
Warren C. Strahle Aug. 1977 71 p refs
(NASA-CR-162571; SU-JIAA-TR-7) Avail: NTIS HC A04/MF A01 CSCL 21B

A review of the subject of combustion generated noise is presented. Combustion noise is an important noise source in industrial furnaces and process heaters, turbopropulsion and gas turbine systems, flaring operations, Diesel engines, and rocket engines. The state-of-the-art in combustion noise importance, understanding, prediction and scaling is presented for these systems. The fundamentals and available theories of combustion noise are given. Controversies in the field are discussed and recommendations for future research are made. J.M.S.

N80-15216# IBM Watson Research Center, Yorktown Heights, N.Y.
TIME-RESOLVED SPECTROSCOPIC STUDIES OF SURFACE REACTIONS
G. W. Rubloff 15 Feb. 1979 20 p refs Presented at the 4th Symp. on Fluid-Solid Surface Interactions, Gaithersburg, Md., 18-20 Oct. 1978
(Contract N00014-77-C-0366)
(AD-A074952) Avail: NTIS HC A02/MF A01 CSCL 20/6

A new dynamic approach to surface reactions is described. A fast-acting UHV gas dosing system is employed to prepare the adsorbate in an initial state under reaction conditions of

elevated temperature and/or pressure (to approx. 1 torr). Individual reaction steps are then resolved in time using photoemission spectroscopy to probe the surface electronic structure, yielding information about the nature of chemisorbed species, the reaction path, and the kinetics of individual reaction steps. Preliminary results are given for an initial application of this approach - the measurement of desorption kinetics for CO on Ni (111). GRA

N80-15217# Tennessee Univ., Knoxville. Dept. of Physics.
VACUUM ULTRAVIOLET ELECTRONIC PROPERTIES OF LIQUIDS Annual Progress Report, 1 Nov. 1978 - 31 Oct. 1979
L. R. Painter 1979 13 p refs
(Contract EY-76-S-05-3861)
(ORO-3861-28) Avail: NTIS HC A02/MF A01

The following materials were studied: formamide, hexamethyl phosphoric triamide, polyethylene, Kapton, anthracene, and several aromatics. Properties determined included optical and related properties. DOE

N80-15218# California Univ., Berkeley. Lawrence Berkeley Lab.
EXPERIMENTAL STUDY OF COMBUSTION IN A TURBULENT BOUNDARY LAYER
R. K. Cheng, R. G. Bill, Jr., F. Robben, R. Schefer, and L. Talbot 1979 10 p refs Presented at the 2d Symp. on Turbulent Shear Flows, London, 2-4 Jul. 1979
(Contract W-7405-eng-48)
(LBL-8946; CONF-790721-1) Avail: NTIS HC A02/MF A01

The effect of H2-air combustion on induced turbulence in a heated boundary layer was studied through time and space resolved measurements of velocity and density. The experimental conditions covered equivalence ratio from 0 to 0.3 wall temperature between 1100 to 1300 K and free stream velocity from 14 to 22 m/sec. Three modes of combustion were indicated: (1) surface reaction; (2) surface reaction combined with gas phase reaction in the boundary layer; and (3) flame-like structure situated at the edge of the boundary layer. Velocity fluctuation of about 4% in the nonheated boundary layer were reduced to 2% by wall heating. Density fluctuptions of 8 to 10% were observed in the heated boundary layer both with and without combustion. The maximum density gradient region of the flame-like structure was found to fluctuate at a fairly regular rate of 0.5 to 1.25 Khz depending on various conditions. DOE

N80-15219# California Univ., Livermore. Lawrence Livermore Lab.
DYNSYL: A GENERAL-PURPOSE DYNAMIC SIMULATOR FOR CHEMICAL PROCESSES
G. K. Patterson and R. B. Rozsa 5 Sep. 1978 97 p refs
(Contract W-7405-eng-48)
(UCRL-52561) Avail: NTIS HC A05/MF A01

The design and implementation of the dynamic chemical plant simulation program DYNSYL are presented. This program can be used to generate process data or to provide estimates of process performance; it simulates both steady-state and dynamic behavior. The MCA methods that may have to be evaluated range from sophisticated on-line material trackers such as Kalman filter estimators, to relatively simple material balance procedures. The overall structure of DYNSYL is described and some example problems are included. The code is still in the experimental stage and revision is continuing. DOE

N80-15220# Department of Energy, Washington, D. C.
ANALYSIS OF HYDROGEN IN SOLIDS
R. L. Schowebel, ed. and J. L. Warren, ed. Apr. 1979 181 p refs Presented at the Workshop on Analysis of Hydrogen in Solids, Albuquerque, N. Mex., 23 Jan. 1979
(Contract DE-AC04-76DP-00789)
(DOE/ER-0026; CONF-790127) Avail: NTIS HC A09/MF A01

The ways to determine the state and dynamics of hydrogen in solids are presented and requirements are formulated for techniques in this capacity. Topics include: the properties of hydrogen in insulating materials; ion channeling studies of hydrogen lattice location; hydrogen depth profiling using elastic recoil detection; and neutron scattering as a technique for the study of hydrogen in metals. A.W.H.

N80-15221# Northwestern Univ., Evanston, Ill.
STUDIES OF METAL-SEMICONDUCTOR INTERFACES IN CATALYSIS AND ENERGY CONVERSION Annual Report, 15 Jun. 1978 - 14 Jun. 1979
Y. W. Chung Mar. 1979 17 p refs
(Contract ER-78-S-02-4946)
(COO-4946-1) Avail: NTIS HC A02/MF A01

The installation of a multiple-technique surface analytical system capable of Auger, photoemission (UPS and XPS), low-energy electron diffraction, thermal desorption and thin-film evaporation studies was completed. An isolation cell attachment was designed for high-pressure gas-phase (1 to 1000 torr) reaction studies. By depositing nickel onto a clean ordered TiO2(110) surface held at room temperature, an ordered overlayer was obtained as evidenced by LEED. Both energy loss and uv photoemission studies showed that there is an electron transport from nickel to TiO2, resulting in an increase of the surface Ti+3 concentration and the formation of an accumulation layer on the TiO2(110) surface. In addition, the Ni atoms and the surface Ti+3 are well dispersed on the TiO2 surface. DOE

N80-15222# Florida Univ., Gainesville.
RADIATION CHEMISTRY OF HYDROCARBON AND ALKYL HALIDE SYSTEMS Progress Report, 1 Aug. 197β - 30 Aug. 1979
R. J. Hanrahan 1979 23 p refs
(Contract EY-76-S-05-3106)
(ORO-3106-71) Avail: NTIS HC A02/MF A01

Deactivation of excited atomic iodine in the P(-2)/sub 1/2/ state was studied. Products of gamma radiolysis of CO-H2 were identified. The photolysis of CF3I-CH3I was studied. DOE

N80-15223# Massachusetts Inst. of Tech., Cambridge.
THEORY OF CHEMICAL KINETICS Progress Report, 16 Jan. 1978 - 15 Jan. 1979
John Ross Jan. 1979 11 p refs
(Contract EY-76-S-02-2873)
(COO-2873-3) Avail: NTIS HC A02/MF A01

The Franck-Condon approximation was applied to chemical dynamics with success. It was used to study angular distributions of reaction products in atom-diatom reactions. Long range transitions in stochastic models were considered. The hydrodynamic stability of stationary and oscillatory convection in binary fluids was also studied along with the efficiency of thermal engines. DOE

N80-15224# Oak Ridge National Lab., Tenn. Analytical Chemical Div.
SINGLE-STAGE MASS SPECTROMETRIC ANALYSES OF RESIN BEAD SAMPLES Progress Report
David H. Smith, R. L. Walker, L. K. Bertram, and J. A. Carter Oct. 1978 16 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6563) Avail: NTIS HC A02/MF A01

The resin bead sample loading technique was applied to a conventional single-stage mass spectrometer equipped with pulse counting. Data obtained are comparable to those obtainable from similar instruments using conventional techniques. DOE

N80-15225# Brookhaven National Lab., Upton, N. Y.
SYNCHROTRON RADIATION: A NEW TOOL FOR BIOPHYSICAL SPECTROSCOPY IN THE VISIBLE AND ULTRAVIOLET
J. C. Sutherland 1978 42 p refs Presented at Synchrotron Radiation Appl. to Biophys., Biochem. and Biomed. Res., Frascati, Italy, 20 Aug. 1978
(Contract EY-76-C-02-0016)
(BNL-24811; CONF-780856-4) Avail: NTIS HC A03/MF A01

Comparisons of synchrotron radiation with conventional sources suggests that the greatest improvements will be realized in the far and vacuum ultraviolet regions-wavelengths less than about 300 nm. Consideration of the transitions of the valence electrons of most organic and biologically important materials indicate that wavelengths less than about 120 nm will not be

especially informative. In addition, spectroscopic experiments at wavelengths less than 105 nm become more difficult because of the loss of window materials and surfaces with high normal incidence reflectance. The characteristic visible and ultraviolet absorption bands of proteins, nucleic acids, and sugars are reviewed. Important spectroscopic techniques such as absorption, natural and magnetic circular dichroism, fluorescence and various fluorescence polarization spectroscopies are described and their potential use in the far and vacuum ultraviolet, (120 to 300 nm) using synchrotron sources is discussed. DOE

N80-15226# Oak Ridge National Lab., Tenn.
MASS AND EMISSIONS SPECTROMETRY IN THE ANALYTICAL CHEMISTRY DIVISION OF OAK RIDGE NATIONAL LABORATORY
D. H. Smith, ed., J. A. Carter, R. L. Walker, L. K. Bertram, D. C. Canada, W. H. Christie, D. L. Donohue, R. E. Eby, J. C. Franklin, L. Landau et al. Nov. 1978 136 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6485); Avail: NTIS HC A07/MF A01

Many different areas of mass spectrometric expertise are represented in the laboratory: gas analysis, high abundance sensitivity measurements, high- and low-resolution organic analyses, spark source trace constituent analysis, and ion micro-probe analysis of surfaces. These capabilities are complemented by emission spectrometry. The instruments are described along with a few applications, some of which are unique. DOE

N80-15227# Brookhaven National Lab., Upton, N. Y.
HIGH TEMPERATURE ELECTROLYSIS
J. R. Powell 1978 6 p refs Presented at the Am. Nucl. Soc. Meeting, San Francisco, 12 Nov. 1979
(Contract EY-76-C-02-0016)
(BNL-26331; CONF-791103-16) Avail: NTIS HC A02/MF A01

An idealized flowsheet for a high temperature electrolysis fusion synthetic fuel plant is given. Two blanket module types are indicated; the first type heats steam or CO2 to high temperatures for the HTE cells (T > or = 1000 C) while the second heats a working fluid for an electrical power cycle and breeds tritium. DOE

N80-15228# National Academy of Sciences - National Research Council, Washington, D. C.
AN EVALUATION OF ACTIVATED CARBON FOR DRINKING WATER TREATMENT
1979 232 p refs
(Contract EPA-68-01-3169)
(PB-299568/8) Avail: NTIS HC A11/MF A01 CSCL 07D

The efficacy of granular activated carbon and related adsorbents to treat drinking water was considered. The potentially harmful health effects that relate to the use of these adsorbents were examined. The pertinent literature was reviewed as well as the scientific data base. A review was included of work on adsorption efficiency, microbial activity on adsorbers, physiochemical interactions, regeneration of adsorbents, and analytical methods to monitor adsorption processes. GRA

N80-15229# Research Triangle Inst., Research Triangle Park, N. C.
STUDY OF THE NATURE OF OZONE, OXIDES OF NITROGEN, AND NONMETHANE HYDROCARBONS IN TULSA, OKLAHOMA. VOLUME 1: PROJECT DESCRIPTION AND DATA SUMMARIES
W. C. Eaton, C. E. Decker, J. B. Tommerdahl, and F. E. Dimmock Apr. 1979 221 p refs
(Contract EPA-68-02-2808)
(PB-300481/9; EPA-450/4-79-008A) Avail: NTIS HC A10/MF A01 CSCL 07D

An air pollution sampling and monitoring project is presented. The monitoring network consisted of eight RTI ground sites and two Tulsa City/County Health Department sites. An airborne measurements program employing a Piper Navaho B was an integral part of the study and is described in detail. Surface data are summarized through tables of mean daily concentrations, cumulative frequency distributions, and diurnal plots. Also included are descriptions and results of the quality control and quality assurance aspects of the field study; an appendix describing the sampling and analytical methodology for GC/FID identification of hydrocarbons; and an appendix describing the sampling and analysis collected on TENAX-GC polymer. GRA

N80-15230# Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group.
CORRELATION AND ESTIMATION OF HYDROCARBON VAPOUR-LIQUID EQUILIBRIUM CONSTANTS AND APPLICATION IN THE CALCULATION OF DEW- AND BUBBLE POINTS OF MULTICOMPONENT MIXTURES
J. D. Raal Aug. 1979 21 p refs
(PB-300477/7; CSIR-CENG-290; ISBN-0-7988-1622-8) Avail: NTIS HC A02/MF A01 CSCL 07D

The logarithm of the equilibrium constant is correlated as a cubic polynomial in temperature for several pressures. Values at intermediate pressures are found by a cubic spline interpolation using a transformed pressure variable. Equilibrium data on the De Priester nomographs for twelve common hydrocarbons ranging from methane to octane are reproduced with very good accuracy for the pressure range 345 kPa to 4.83 MPa and for temperatures from 10 C to about 200 C. For pressures above 4.83 MPa, where composition effects cannot be ignored, extrapolation based on the concept of convergence pressure produces predictions in fair agreement with experimental data. GRA

N80-15231# National Materials Advisory Board, Washington, D. C. Commission on Sociotechnical Systems.
TEST EQUIPMENT FOR USE IN DETERMINING CLASSIFICATIONS OF COMBUSTIBLE DUSTS
1979 45 p refs
(Contract DOL-J-9-F-5-0070)
(PB-300615/2; NMAB-353-2) Avail: NTIS HC A03/MF A01 CSCL 21B

Methods are presented for determining the layer ignition temperature and the electrical resistivity of dusts. The procedures for these recommended tests are described. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-15232*# Wyoming Univ., Laramie. Composite Materials Research Group.
ENERGY ABSORPTION MECHANISMS DURING CRACK PROPAGATION IN METAL MATRIX COMPOSITES Interim Report, Aug. 1978 - Aug. 1979
Daniel P. Murphy and Donald F. Adams Oct. 1979 92 p refs
(Grant NsG-3217)
(NASA-CR-162574; UWME-DR-901-103-1) Avail: NTIS HC A05/MF A01 CSCL 11F

The stress distributions around individual fibers in a unidirectional boron/aluminum composite material subjected to axial and transverse loadings are being studied utilizing a generalized plane strain finite element analysis. This micromechanics analysis was modified to permit the analysis of longitudinal sections, and also to incorporate crack initiation and propagation. The analysis fully models the elastoplastic response of the aluminum matrix, as well as temperature dependent material properties and thermal stress effects. The micromechanics analysis modifications are described, and numerical results are given for both longitudinal and transverse models loaded into the inelastic range, to first failure. Included are initially cracked fiber models. M.M.M.

N80-15233*# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
AN INVESTIGATION OF THE INITIATION STAGE OF HOT CORROSION IN Ni-BASE ALLOYS Semiannual Report, 1 Mar. 1979 - 31 Aug. 1979
T. T. Huang and G. H. Meier 1979 70047 p refs
(Grant NsG-3214)
(NASA-CR-159718; SETEC-MME-79-61; SAR-2) Avail: NTIS HC A03/MF A01 CSCL 11F

The commercial nickel base alloy, IN-738, and high purity

laboratory alloys were prepared to simulate the effects of the major elements in IN-738. Results indicate that the initiation of hot corrosion attack of IN-738 and other similar alloys is the result of local penetration of molten salt through the protective oxide scale. R.C.T.

N80-15234*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION AND FRICTION OF IRON-BASE BINARY ALLOYS IN CONTACT WITH SILICON CARBIDE IN VACUUM
Kazuhisa Miyoshi and Donald H. Buckley Jan. 1980 13 p refs
(NASA-TP-1604; E-126) Avail: NTIS HC A02/MF A01 CSCL 11F

Single pass sliding friction experiments were conducted with various iron base binary alloys (alloying elements were Ti, Cr, Mn, Ni, Rh, and W) in contact with a single crystal silicon carbide /0001/ surface in vacuum. Results indicate that atomic size and concentration of alloying elements play an important role in controlling adhesion and friction properties of iron base binary alloys. The coefficient of friction generally increases with an increase in solute concentration. The coefficient of friction increases linearly as the solute to iron atomic radius ratio increases or decreases from unity. The chemical activity of the alloying elements was also an important parameter in controlling adhesion and friction of alloys, as these latter properties are highly dependent upon the d bond character of the elements. R.C.T.

N80-15235*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF SODIUM, POTASSIUM, MAGNESIUM, CALCIUM, AND CHLORINE ON THE HIGH TEMPERATURE CORROSION OF IN-100, U-700, IN-792, AND MAR M-509
Carl E. Lowell, Steven M. Sidik, and Daniel L. Deadmore 1980 28 p refs Proposed for presentation at 25th Ann. Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by the ASME
(Contract EF-77-A-01-2593)
(NASA-TM-79309; E-265; DOE/NASA/2593-79/12) Avail: NTIS HC A03/MF A01 CSCL 07D

The effects of potential impurities such as Na, K, Mg, Ca, and Cl, in coal-derived liquid fuels on accelerated corrosion of IN-100, U-700, IN-792, and Mar M-509 were investigated using a Mach 0.3 burner rig for times to 200 hours in one hour cycles. These impurities were injected in combination as aqueous solutions into the combustor. Other variables were time, temperature, and fuel-to-air ratio. The experimental matrix was a central composite fractional fractorial design divided into blocks to allow modification of the design as data was gathered. The extent of corrosion was determined by metal consumption. The time exponent was near 1.0 for the least corrosion resistant alloys, U-700 and IN-100; near 0.8 for the moderately resistant IN-792; and close to Mar M-509, the most corrosion resistant alloy. As anticipated, corrosion rapidly increased with increasing temperature as well as Na and K concentrations, while corrosion decreased somewhat as the Ca concentration increased for all alloys. Mg was beneficial for the Ni-base alloys but had little effect on the Co-base alloy. Surprisingly, the effect of increasing Cl was to decrease the corrosion of all alloys. Little interaction among the dopants was noted. A.R.H.

N80-15236# Rockwell International Science Center, Thousand Oaks, Calif.
TREATMENT OF AM 355 STEEL FOR ADHESIVE BONDING Final Report, 12 Jun. 1978 - 31 May 1979
Ron Haak and Tennyson Smith Jul. 1979 66 p refs
(Contract DAAK10-78-C-0227)
(AD-A074113; SC5169.16FR) Avail: NTIS HC A04/MF A01 CSCL 11/1

Surface treatments for Am 355 prior to adhesive bonding have been developed. A sulfuric acid-dichromate immersion treatment and nitric acid anodization treatment have produced extremely strong durable bonds. Wedge test values (at 50 C using 0.040 in. (0.102 cm) stock) are about 0.05-0.06 in./24 hr (0.13-0.15 cm/24 hr). Using a method now in use (HP4-121) results of greater than 1 in./day (2.5 cm) are obtained. Stress durability (ASTM D2919, 60 C, 100% RH, 2000 psi (13.8 mPa)) tests show an average time to failure of about 500 hrs compared to the less than 1 hour time to failure obtained using the present method. It was found that increased bond durability, measured by the wedge test, was directly related to the increased chromium content of the surface oxide layer produced using these and other treatments. Experiments indicate that Am 355 is essentially impermeable to hydrogen, i.e., the diffusion coefficient was unmeasurable using an electrochemical technique sensitivite to 0.1 ppm of mobile hydrogen. Although both methods mentioned above are commercially applicable, the HNO3 anodize appears the best because of the absence of carcinogenic dichromates, the lower production cost and slightly better bond results. GRA

N80-15237# Westinghouse Research and Development Center, Pittsburgh, Pa.
ENVIRONMENTAL HYDROGEN CRACKING OF HY STEEL WELD METALS Final Report, 1 May 1977 - 30 Jun. 1979
E. W. Johnson and B. J. Shaw 15 Aug. 1979 175 p refs
(Contract N00014-77-C-0372)
(AD-A074104; Rept-79-9D9-HONRY-R1) Avail: NTIS HC A08/MF A01 CSCL 11/6

Techniques used in a program to develop HY steel weld metals with improved resistance to environmental hydrogen cracking include (1) levitation melting and chill casting of Charpy-size specimens, and (2) accelerated environmental testing by the H2S rising-load method. The measured values of K(or), the stress intensity of crack-growth onset, had satisfactory reproducibility as well as sensitive response to composition. However, K(or) is larger than the threshold stress intensity K(arr) (or K(iscc)) by an amount that varies directly with t(io), the incubation-time constant. Since t(io) is short relative to design life, only k(arr) has design significance. Two new accelerated methods of determining K(arr) are (1) a modified rising-load test in which the displacement is held constant after crack-growth onset, and (2) a similar procedure substituting environmental fatigue precracking for the rising-load phase. GRA

N80-15238# Naval Postgraduate School, Monterey, Calif.
HIGH-STRENGTH ALUMINUM-MAGNESIUM ALLOYS: THERMOMECHANICAL PROCESSING, MICROSTRUCTURE AND TENSILE MECHANICAL PROPERTIES M.S. Thesis
Raymond Arthur Grandon Mar. 1979 74 p refs
(AD-A074185) Avail: NTIS HC A04/MF A01 CSCL 11/6

Microstructures and mechanical properties of thermomechanically processed aluminum-magnesium alloys were investigated in this research. Magnesium content of the alloys ranged from 7 to 12 weight percent and an alloy containing 10 percent Mg and 0.5 percent Cu was also examined. Thermomechanical processing treatments involved solution treatment followed by warm isothermal rolling. Temperature for this warm rolling was typically 300 C, and this is below the solvus temperature for the alloy. Such processing results in a fine dispersion of the intermetallic compound Al3Mg2 (beta) in a solid solution matrix. Typical mechanical properties are an ultimate tensile strength of 520 Mpa (75000 psi), with 12 percent elongation to fracture. Such a material may be further cold worked to ultimate tensile strengths of 620 Mpa (90000 psi), with 6 percent elongation to fracture. Dynamic recrystallization is necessary to achieve a uniform dispersion of the intermetallic in subsequent processing. GRA

N80-15239# Northwestern Univ., Evanston, Ill. Dept. of Materials Science
ANOMALIES IN X-RAY RESIDUAL STRESS MEASUREMENTS IN COLD-ROLLED STEELS
Heiner Doelle and Jerome B. Cohen 7 Sep. 1979 29 p refs
(Contract N00014-75-C-0580; Grant NSF DMR-76-80847)
(AD-A074802; TR-25) Avail: NTIS HC A03/MF A01 CSCL 11/6

In residual stress measurements with X-rays, the interplanar spacing is assumed to alter monotonically with the tilt psi of the specimen to the X-ray beam; the calculation of the stresses is based on this assumption when either the well-known two-tilt or sin sq psi methods are employed. But in materials with strong texture, large oscillations have sometimes been reported. A method proposed in the literature for evaluating stresses in such a situation

as resulting from anisotropy has been tested and shown to provide a reasonable stress system; the texture must be known in detail, so as to calculate the effective elastic constants. More importantly, the theory predicts that the simpler methods and measured X-ray elastic constants can be used, and without knowledge of the texture, if hoo and hhh reflections are employed; this has been verified experimentally in this study. It is recommended that such reflections be employed in the future, rather than the common ones now utilized. GRA

N80-15240# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering, and Mechanics.

UNIAXIAL CREEP, CYCLIC CREEP AND RELAXATION OF AISI TYPE 304 STAINLESS STEEL AT ROOM TEMPERATURE: AN EXPERIMENTAL STUDY

D. Kujawski, V. Kalliapur, and E. Krempl Aug. 1979 45 p refs Sponsored in part by NSF

(Contract N00014-76-C-0231; NR Proj. 064-571)

(AD-A074958; RPI-CS-79-4) Avail: NTIS HC A03/MF A01 CSCL 11/6

A servocontrolled testing machine and strain measurement at the gage length were used to study the uniaxial rate (time) dependent behavior of AISI Type 304 Stainless Steel at room temperature. The creep strain accumulated in a given period of time depends strongly on the stress rate preceding the creep test. In constant stress rate zero-to-tension loading the creep strain accumulated in a fixed time period at a given stress level is always higher during loading than during unloading. Continued cycling causes an exhaustion of creep ratchetting which depends on the stress rate. Periods of creep and relaxation introduced during completely reversed plastic cycling show that the curved portions of the hysteretic loop exhibit most of the inelasticity. In the straight portions creep and relaxation are small and there exists a region commencing after unloading where the behavior is similar to that at the origin for virgin materials. This region does not extend to zero stress. The results are at variance with creep theory and with viscoplasticity theories which assume that the yield surface expands with the stress. They support the theory of viscoplasticity based on total strain and overstress. GRA

N80-15241# Georgia Inst. of Tech., Atlanta. School of Physics.

THEORETICAL INVESTIGATION OF THE EXCITATION STRUCTURE AND OPTICAL PROPERTIES OF TITANIUM, VANADIUM AND THEIR OXIDES Annual Report, 1 Oct. 1976 - 30 Sep. 1977

Martin W. Ribarsky 8 Jul. 1979 13 p refs

(Grant AF-AFOSR-3108-76; AF Proj. 2301)

(AD-A074222; AFOSR-79-0971TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

An investigation of the electronic excitation structure of the transition metal oxides was begun which included the effects of correlation of the excited electron with the surrounding medium relaxation of the electrons around the hole left by the excitation, and the interaction of the excited electron with the hole. Recent theoretical and experimental work has shown that all these effects must be included in order to obtain a detailed understanding of the excitation structure, optical properties, lattice dynamics, and dielectric response of these oxides and many other materials. Local orbitals instead of the usual spatially extended Bloch representation were used. The local orbitals are especially useful in describing the d-electrons, which are localized in position and energy. The extensive codes necessary for the efficient calculation of multicenter integrals were constructed and assembled during the past year. The methods necessary for transforming the band states from the Bloch to the local orbitals representation were developed, and the methods for diagonalizing very large array were investigated. GRA

N80-15242# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

PROGRESS IN CALCULATIONS OF THE SUPERCONDUCTING PROPERTIES OF TRANSITION METALS

W. H. Butler 1979 14 p refs Presented at Conf. on Superconductivity in d- and f-band Metals, San Diego, Calif., 21 Jun. 1979

(Contract W-7405-eng-26)

(CONF-790653-4) Avail: NTIS HC A02/MF A01

First principles, calculations of the electron-phonon parameters of d-band metals are performed to an accuracy of about 10% for averaged quantities such as the mass enhancement or the room temperature resistivity. Quantities such as the spectral function or the phonon linewidth which describe the electron-phonon interaction in more detail are also calculated. Agreement between calculated and experimental phonon linewidths is generally good but there are differences between the experimental and calculated versions of the spectral function. Calculations of the thermodynamic critical field and the upper critical field for Nb agree well with experiment. DOE

N80-15243# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

EFFECTS OF AIR MELTING ON Fe/0.3/3Cr/0.5Mo/2Mn AND Fe/0.3C/3Cr10.5Mo/2Ni STRUCTURAL ALLOY STEELS M.S. Thesis

B. Steinberg Jun. 1979 50 p refs

(Contract W-7405-eng-48)

(LBL-9103) Avail: NTIS HC A03/MF A01

A base alloy of Fe/03C/3Cr/0.5Mo with either 2Mn or 2Ni added was produced by air melting, and its mechanical properties and microstructure were compared to an identical vacuum melted steel. Significant differences in mechanical behavior, morphology, and volume fraction of undissolved inclusion were observed as a function of composition following air melting. For the alloy containing manganese, all properties remained very close to vacuum melted values but the 2Ni alloy displayed a marked loss in Charpy impact toughness and plane strain fracture toughness. This loss is attributed to an increase in volume fraction of secondary particles in the nickel alloy, as opposed to both the Mn alloy and vacuum melted alloys, as well as to substantially increased incidence of linear coalescence of voids. Microstructural features are discussed. DOE

N80-15244# California Univ., Berkeley. Lawrence Berkeley Lab.

DESIGN OF DUPLEX LOW-CARBON STEELS WITH CARBIDE FORMING ELEMENTS

P. K. Costello Dec. 1978 65 p refs

(Contract W-7405-eng-48)

(LBL-8628) Avail: NTIS HC A04/MF A01

Duplex ferrite-martensite (DFM) steels with carbide forming elements were investigated. The alloys Fe/0.14.C/1.45 Si/X(X being the substitutional alloying element of Mos or Nb) were selected. The DFM microstructures are controlled by the type of alloy element and the subsequent thermal treatment. The tensile properties of specimens subjected to either the intermediate quench (IQ) or the intermediate air cool (IAC) heat treatments were correlated with their respective microstructures. Dispersion hardening as a secondary strengthening mechanism is found to limit the ductility and increasing the strength due to carbide precipitation in the ferrite. The differences in properties displayed by the alloys between the IG and IAC thermal treatments are primarily attributed to the connectivity of the martensite particles. The IQ treatment provided strength and elongation ductility combinations which are superior to those of the IAC process. Specifically, the niobium steel displayed the best mechanical properties. DOE

N80-15245# Northwestern Univ., Evanston, Ill.

EFFECT OF POINT DEFECTS ON MECHANICAL PROPERTIES OF METALS Progress Report, 1 Jan. - 30 Nov. 1978

M. Meshii Nov. 1978 24 p refs

(Contract EY-76-S-02-1367)

(COO-1367-97) Avail: NTIS HC A02/MF A01

Progress is reported on deformation behavior of niobium single crystals below 77 K, the effect of electron irradiation on the deformation behavior of niobium single crystals, and surface film softening phenomenon in Ni plated iron single crystals. DOE

N80-15246# Wright State Univ., Dayton, Ohio.

LOW TEMPERATURE ELECTRON IRRADIATION AND ANNEALING OF PURE CADMIUM Ph.D. Thesis

M. A. Menendez 1979 74 p refs Prepared jointly with Illinois Univ. at Urbana-Champaign

(Contract EY-76-C-02-1198)

(COO-1198-1274) Avail: NTIS HC A04/MF A01

Cadmium was studied after electron irradiation below 2 K, and the damage production rate in Dc was 1/(4.13 + or - .16) x 10 to the twenty sixth power Omega cm/el-)/sq cm) for irradiation with 2.5 MeV electrons at 1.5 K. New annealing peaks were observed at 1.825 K and at about 2 K. The peak at about 2 K exhibits dose-dependence, but it is better described by first order kinetics; this peak is believed to correspond to the long-range migration of the self-interstitial, preferentially to impurities where they form clusters. It was found that subthreshold irradiation results in the annealing of damage already present. This radiation annealing effect may be a contributing factor to the seesaw effect. Another physical process may contribute to the seesaw effect, namely, the trapping of interstitials at impurities and their subsequent detrapping during annealing. DOE

N80-15247# Argonne National Lab., Ill.

PHOTOELECTRON SPECTRA OF TRINUCLEAR METAL CLUSTER COMPLEXES

W. C. Trogler (Northwestern Univ., Evanston, Ill.) and J. Berkowitz 1979 5 p Presented at the Ann. Conf. on Mass Spectry. and Allied Topics, Seattle, 3 Jun. 1979

(Contract W-31-109-eng-38)

(CONF-790658-7) Avail: NTIS HC A02/MF A01

The photoelectron spectra of Re3Cl9, Ru3(CO)12, and Os3(CO)12 were studied. Probable molecular structures in the vapor phase are discussed. DOE

N80-15248# Ames Lab., Iowa.

EFFECT OF NITROGEN CONCENTRATION ON TEMPERATURE DEPENDENT MECHANICAL PROPERTIES OF VANADIUM

O. N. Carlson, D. K. Rehbein, and K. E. Bogacik (Babcock, and Wilcox Co., Lynchburg, Va.) 1979 13 p refs Presented at 5th Intern. Conf. on the Strength of Metals and Alloys, Aachen, W. Germany, Aug. 1979

(Contract W-7405-eng-82)

(IS-M-195; CONF-790801-1) Avail: NTIS HC A02/MF A01

The critical resolved shear stress and strain rate sensitivity of vanadium were determined for vanadium-nitrogen alloys over the temperature range of 77 K to 400 K for concentrations of 1 to 500 wt ppM nitrogen. The concentration dependence of the hardening rate agrees quite well with either the Fleischer or Labusch strengthening model, but the combined temperature and concentration dependence follows more closely the form predicted by Ono and Sommer. The strain rate sensitivity exhibits a peak at 140 K which decreases with increasing nitrogen content but above 250 K there is a reversal in this effect. DOE

N80-15249# Foreign Resources Associates, Fort Collins, Colo.

EVALUATION OF FORGEABILITY OF STEELS BY NOTCH COMPRESSION METHOD

F. Morozumi and M. Hirasaka Mar. 1979 15 p refs Translated into ENGLISH from Zairyo (Kawasaki), v. 45, no. 3, 1970 p 97-102 Sponsored by DOE

(RFP-Trans-273) Avail: NTIS HC A02/MF A01

Notched specimens prepared from carbon, low alloy, and alloy steels were compressed by impact energy, and the relationship between the behavior of forging defects produced at the notch bottom and the amount of compression was investigated. It was ascertained that the critical impact compression amount has a close relation with individual metallurgical factors such as material and conditions. Furthermore, this notch compression method proved to be an effective means for understanding the generation of flaws in the forging. DOE

N80-15250# Oak Ridge National Lab., Tenn.

FATIGUE CRACK PROPAGATION IN 21/4 Cr-1 Mo STEEL

W. R. Corwin, M. K. Booker, B. L. P. Booker, and C. R. Brinkman 1979 8 p refs Presented at Intern. Conf. on Structural Mech. in Reactor Technol., Berlin, 13 Aug. 1979

(Contract W-7405-eng-26)

(CONF-790802-41) Avail: NTIS HC A02/MF A01

The fatigue crack propagation of 2 1/4 Cr-1 Mo steel was examined in air over a wide range of experimental conditions. The fatigue crack growth rate was found to: generally increase monotonically with increasing temperature from 172 to 866 K, except in the range where dynamic strain aging occurs, near 644 K; increase with decreasing frequency at room temperatures above 783 K - this frequency dependence was not observed below 783 K; and increase with increases in mean stress. The results were evaluated, and a simple empirical model was developed to yield estimates of average and upper limit crack growth rates as a function of temperature, frequency, and effective stress intensity. The model is not applicable in the low region where threshold effects become important since insufficient data were available in that range. DOE

N80-15251# General Atomic Co., San Diego, Calif.

AGING BEHAVIOR OF ALLOY 800H AND ASSOCIATED MECHANICAL PROPERTY CHANGES

G. Y. Lai and O. F. Kimball Nov. 1978 27 p refs

(Contract EY-76-C-03-0167)

(GA-A-15194) Avail: NTIS HC A03/MF A01

Aging behavior of five different heats of Alloy 800H was investigated in the temperature range 538 to 816 C for times up to 8,000 h. Significant age-hardening was observed at low temperatures in most heats. One of the heats, however, exhibited less hardening. Microstructural changes occurring during aging were evaluated by optical metallography, transmission electron microscopy, and X-ray diffraction. Effects of thermal aging on both tensile properties and impact toughness properties were evaluated. The results show that the alloy exhibits good residual impact toughness and tensile ductility after aging up to 8,000 h. DOE

N80-15252# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

CORROSION OF SEVERAL ALLOYS IN SUPERHEATED STEAM AT 482 AND 538 DEG CENTIGRADE

J. C. Griess and W. A. Maxwell (NUS Corp., Clearwater, Fla.) Nov. 1978 39 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6465) Avail: NTIS HC A03/MF A01

The corrosion of several ferritic steels, Incoloy Alloy 800, Inconel 617, and type 304 stainless steel in superheated steam at 482 and 538 C was investigated. Specimens of the alloys, including welds and U-bends in some cases, are mounted in a once-through loop that receives steam from a fossil-fired power plant. The data obtained during the first 12,000 h of a planned 30,000-h test is presented. All ferritic steels showed similar weight gains and to this time no significant oxide exfoliation has occurred. The other materials corroded at very low rates. Incoloy Alloy 800 that was intergranularly corroded during pickling showed no further intergranular penetration in steam. Type 304 stainless steel was oxidized in a noununiform manner, but even in the effected areas attack was slight. Welded and highly stressed U-bend specimens of Inconel 617 and of Incoloy Alloy 800 welded either to itself or to 2 1/4 Cr-1 Mo steel, showed no evidence of cracking nor any unusual oxide loss. DOE

N80-15253# Sandia Labs., Albuquerque, N. Mex.

REFRACTORY METALS FOR ULTRASONIC THERMOMETRY APPLICATION

Gary A. Carlson and H. G. Plein Oct. 1978 74 p refs

(Contract EY-76-C-04-0789)

(NUREG-CR-0368; SAND-78-1382) Avail: NTIS HC A04/MF A01

The acoustic velocity and acoustic attenuation characteristics of 13 refractory metals were determined over a range of temperatures in order to explore potential new ultrasonic thermometry materials. Stainless steel, titanium, rhodium, rhenium, and 2 percent thoriated tungsten wires show superior properties for ultrasonic thermometry over different temperature ranges from room temperature to 2900 C. Applications to reactor safety experiments are discussed. DOE

N80-15254# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.

GOLD PLATING METALLIZED ALUMINA CERAMICS

T. J. Gillespie and R. J. Antepenko 30 Oct. 1978 44 p

(Contract EY-76-C-04-0656)

(GEPP-TIS-380) Avail: NTIS HC A03/MF A01

Problems with gold plating a metallized ceramic part were investigated. The production process was improved by increasing the amounts of conductive plating salts and brightener in the

plating bath and increasing the bath agitation. Various surface activation processes, retort sintering of the gold plate and seven cyanide gold plating baths were evaluated. The long-range study shows that the most effective activation for metallized ceramic is a cathodic treatment for approximately one minute at low current density using a 10 percent sulfuric acid solution. One plating bath provided excellent surface texture and blister-free surface when used with a strike process in conjunction with activation and retort furnace sintering. DOE

N80-15255# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.

MODIFICATIONS IN OPTOELECTRONIC BEHAVIOR OF PLASMA-DEPOSITED AMORPHOUS SEMICONDUCTOR ALLOYS VIA IMPURITY INCORPORATION

R. W. Griffith, F. J. Kampas, P. E. Vanier, and M. D. Hirsch 1979 7 p refs Presented at the Intern. Conf. on Amorphous and Liquid Semiconductors, Cambridge, Mass., 27 Aug. 1979

(Contract EY-76-C-02-0016)

(BNL-26646; , CONF-790851-3) Avail: NTIS HC A02/MF A01

Electronic properties of plasma-deposited a-Si:H alloys are discussed as functions of oxygen and nitrogen impurities. Data show anomalous behavior in photoconductivity versus temperature for films deficient in either, or both, impurities (peaks appear that are associated with thermal-quenching processes and supralinearity). Modification to classic behavior in photoconductivity owing to synergistic effects of oxygen and nitrogen is also demonstrated. Correlations with photoluminescence are presented. Optical emission spectroscopy is discussed within the context of an emerging spectroscopy for the detection of emitting reactive species in the plasma. The presence of impurities, particularly N2, can be diagnosed. DOE

N80-15256# California Univ., Livermore. Lawrence Livermore Lab.

TANTALUM FABRICATION

P. L. Studt 11 Apr. 1979 20 p refs

(Contract W-7405-eng-48)

(UCID-18152) Avail: NTIS HC A02/MF A01

The as-fabricated metallurgical state of the tantalum was examined. The microstructure, hardness, and chemical composition of the component material was evaluated. Both as-received tantalum starting sheets and a formed component were evaluated. Results indicate that these components were given an anneal that relieved stresses but did not recrystallize the material. The components were thus stronger than necessary. DOE

N80-15257# Atomics International Div., Golden, Colo. Rocky Flats Plant.

ALTERNATE IMMERSION STRESS CORROSION TESTING OF 5083 ALUMINUM

J. L. Briggs, M. R. Dringman, D. E. Hausburg, and R. L. 13 Nov. 1978 17 p refs

(Contract EY-76-C-04-3533)

(RFP-2645; TID-4500-R66) Avail: NTIS HC A02/MF A01

The stress corrosion susceptibility of an aluminum-magnesium alloy in plate form and press formed shapes was determined in the short transverse direction. The C ring specimens were exposed to alternate immersion in a sodium chloride solution. The test equipment and procedure, with several innovative features, are described in detail. Statistical test results are listed for seven thermomechanical conditions. A certain processing scheme was shown to yield a work strengthened part that is not sensitized with respect to stress corrosion cracking. DOE

N80-15258# General Electric Co., Schenectady, N. Y.

NITROGEN-STRENGTHENED AUSTENITIC STAINLESS STEEL FOR CRYOGENIC MAGNET STRUCTURES

F. N. Mazandarahy, D. M. Parker, R. F. Koenig, and D. T. Read 1979 20 p refs Presented at the Cryogenic Engineering Conf., Madison, Wisc., 21 Aug. 1979 Prepared jointly with NBS, Washington, D.C.

(Contract W-7405-eng-26)

(CONF-790815-13) Avail: NTIS HC A02/MF A01

An extensive test program was initiated to verify expected base metal properties, to develop weld processes and to establish weld and base metal design allowables. The results of the tests which involved testing and evaluation of 25 mm thick Type 316 LN plate, shielded metal arc weld deposits selected for structural welds, gas tungsten arc weld and gas metal arc weld deposits selected for seal welds are presented. The welding development effort measurements of impact properties at RT and 77 K; chemical analyses; measurements of magnetic permeabilities and weld ferrite contents, metallographic and radiographic examinations of welds, and measurements of tensile, fracture toughness and fatigue crack growth rate properties from RT to 4 K. DOE

N80-15259# Argonne National Lab., Ill.

LONG-TERM EROSION MONITORING OF METALLIC CONDUITS BY ULTRASONIC PULSE-ECHO TECHNIQUES

C. A. Youngsdahl and W. A. Ellingson 1979 11 p refs Presented at 12th Symp. on Nondestructive Evaluation, San Antonio, Tex., 24 Apr. 1979

(Contract W-31-109-eng-38)

(CONF-790480-1) Avail: NTIS HC A02/MF A01

Monitoring metallic transfer lines and fittings in pressurized equipment used to process particulate matter, such as pulverized coal or ash, can prevent unexpected component failures and contribute to improved equipment designs. Nondestructive, ultrasonic pulse-echo techniques to detect erosion were developed for high-temperature (approximately 650 C) on-line measurements and applied to various stainless steel and carbon steel components of coal-gasification and liquefaction pilot plants. The techniques are described, together with successful methods of accounting for varying specimen temperatures, long monitoring times (months to years), and exposure of transducers and couplant to weather. Measurement characteristics peculiar to erosion monitoring are discussed. DOE

N80-15260# National Technical Information Service, Springfield, Va.

TITANIUM AND TITANIUM ALLOY CREEP. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Sep. 1979

William E. Reed Sep. 1979 202 p Supersedes NTIS/PS-78/0970; NTIS/PS-77/0803; NTIS/PS-76/0645; NTIS/PS-75/538

(NTIS/PS-79/0984/9; NTIS/PS-78/0970; NTIS/PS-77/0803; NTIS/PS-76/0645; NTIS/PS-75/538) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Research is cited on creep of titanium and its alloys with regard to composition, stress corrosion, fatigue, fracture, and microstructure. Tests are described on varying conditions of temperatures, pressures, and atmospheres. Processing and metal working are covered for their relationship to creep resistance. Many reports deal with applications to aircraft, spacecraft, and nuclear reactors. This updated bibliography contains 194 abstracts, 14 of which are new entries to the previous edition. GRA

N80-15261# National Center for Resource Recovery, Washington, D. C.

TECHNICAL BARRIERS TO THE REUSE OF ALUMINUM RECOVERED FROM MUNICIPAL REFUSE

E. Joseph Duckett Mar. 1979 34 p refs

(Grant NSF APR-75-13864)

(PB-300436/3; NSF/RA-790147; TI79-5) Avail: NTIS HC A03/MF A01 CSCL 11F

The recovery of aluminum from municipal solid wastes (MSW) is examined. Since organic contaminants are present in recovered aluminum, and since the mixing of aluminum and other nonmagnetic metal alloys found in MSW are potential barriers to the use of recovered aluminum, these problems and methods available to overcome them are presented. Techniques for recovering aluminum from MSW described include the principle of eddy current separation (both wet and dry methods), dense media separation, jigging, and electrostatic separations. Types of aluminum alloys and other alloys are listed according to classification and usage. Specifications used as a basis for judging the quality of aluminum recovered from U.S. plants are outlined. GRA

N80-15262# Industry and Trade Administration, Washington, D.C.

PRODUCTION OF IRON BY DIRECT REDUCTION

William S. Kruppa May 1979 19 p
(PB-300533/7) Avail: NTIS HC A02/MF A01 CSCL 11F

World-wide iron ore direct reduction units are described. The descriptions of these units include location, owners or planners, status of development-in operation or some stage of construction or planning, design capacity, and actual or intended use of the iron product. A summation of the data present the world-wide current and projected direct reduction process design capacity. Limited data are also presented which show current and projected actual direct iron production. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-15263*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
SINTERED SILICON NITRODE RECUPERATOR FABRICATION Final Report
A. Gatti, W. S. Chiu, and L. R. McCreight Jan. 1980 40 p refs
(Contract DEN3-54)
(NASA-CR-159706; DOE/NASA/0054-79/1) Avail: NTIS HC A03/MF A01 CSCL 11B

The preliminary design anp a demonstration of the feasibility of fabricating submodules of an automotive Stirling engine recuperator for waste heat recovery at 370 C are described. Sinterable silicon nitride (Sialon) tubing and plates were fabricated by extrusion and hydrostatic pressing, respectively, suitable for demonstrating a potential method of constructing ceramic recuperator-type heat exchangers. These components were fired in nitrogen atmosphere to 1800 C without significant scale formation so that they can be used in the as-fired condition. A refractory glass composition (Al2O3 x 4.5 CaO.MgO x 11SiO2) was used to join and seal component parts by a brazing technique which formed strong recuperator submodules capable of withstanding repeated thermal cycling to 1370 C. The corrosion resistance of these materials to Na2SO4 + NaCl carbon mixtures was also assessed in atmospheres of air, hydrogen and CO2-N2-H2O mixtures at both 870 C and 1370 C for times to 1000 hours. No significant reaction was observed under any of these test conditions. M.M.M.

N80-15264*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ANALYSES OF MOISTURE IN POLYMERS AND COMPOSITES
L. E. Ryan and R. W. Vaughan 11 Jan. 1980 99 p refs
(Contract NAS3-20406)
(NASA-CR-159745; TRW-31782-6082-RU-00) Avail: NTIS HC A05/MF A01 CSCL 07C

A suitable method for the direct measurement of moisture concentrations after humidity/thermal exposure on state of the art epoxy and polyimide resins and their graphite and glass fiber reinforcements was investigated. Methods for the determination of moisture concentration profiles, moisture diffusion modeling and moisture induced chemical changes were examined. Carefully fabricated, precharacterized epoxy and polyimide neat resins and their AS graphite and S glass reinforced composites were exposed to humid conditions using heavy water (D2O), at ambient and elevated temperatures. These specimens were fixtured to theoretically limit the D2O permeation to a unidirectional penetration axis. The analytical techniques evaluated were: (1) laser pyrolysis gas chromatography mass spectrometry; (2) solids probe mass spectrometry; (3) laser pyrolysis conventional infrared spectroscopy; and (4) infrared imaging thermovision. The most reproducible and sensitive technique was solids probe mass spectrometry. The fabricated exposed specimens were analyzed for D2O profiling after humidity/thermal conditioning at three exposure time durations. R.C.T.

N80-15265# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
THE PHYSICAL AND CHEMICAL CHARACTERIZATION OF TEN MILITARY TURBINE ENGINE LUBRICANTS Final Report, Jul. - Sep. 1979
Frank M. Newman and Leo L. Stavinoha Sep. 1979 32 p refs
(Contract DAAK70-79-C-0142)
(AD-A074073; AFLRL-115) Avail: NTIS HC A03/MF A01 CSCL 11/8

Four MIL-L-23699B and six MIL-L-7808G turbine engine lubricants have been characterized from the physical properties and chemical composition of their basestocks. The four MIL-L-23699 lubricants were found to be 100% polyol esters. Of the six MIL-L-7808 lubricants, four were mixtures of polyol esters and diesters, one was 100% polyol ester, and one was 100% diester. Correlation of the chemical data is made to some of the physical properties wherever possible. GRA

N80-15266# Naval Surface Weapons Center, White Oak, Md.
MOISTURE SORPTION AND DIFFUSION IN KEVLAR 49 ARAMID FIBER Progress Report, Oct. 1977 - Oct. 1978
Joseph M. Augl 30 Mar. 1979 48 p refs
(AD-A074547; NSWC/TR-79-51) Avail: NTIS HC A03/MF A01 CSCL 11/9

Kevlar is being used increasingly as a reinforcement for fibrous composites. Since moisture affects the mechanical properties of organic matrix composite it is of importance to understand the sorption and transport of moisture in this material. The purpose of this work was to measure the sorption equilibrium of Kevlar with moisture and its diffusion coefficient as a function of concentration. Kevlar 49 has an unusually low diffusion coefficient compared to other polymers, so that the moisture transport in composites is governed by the organic matrix, or by other mechanisms such as microporosity, yet the equilibrium concentrations as a function of relative humidity are similar to most epoxy resins. GRA

N80-15267# Army Inst. of Dental Research, Washington, D. C. Dental Materials Div.
APPARENT VISCOSITIES OF SETTING ELASTOMERS
Stanley G. Vermilyea, Eugene F. Huget, and Laszlo B. DeSimon 2 Oct. 1979 12 p refs
(AD-A074843) Avail: NTIS HC A02/MF A01 CSCL 11/9

The flow behavior of five elastomeric impression materials was determined by extrusion viscometry. Initial viscosity ranged from 400 to 5,100 poise at a shear rate of 2.2 reciprocal seconds. All of the elastomers showed initial non-Newtonian behavior and increased viscosity with time. The data suggest that clinical impression making procedures should be tailored to produce rates of shear commensurate with those required to optimize the flow properties of modern impression materials. GRA

N80-15268# Texas Technological Univ., Lubbock. Dept. of Chemistry.
STUDIES OF HnFn OLIGOMERIC SPECIES Final Report, 1 Jun. 1978 - 31 May 1979
Richard L. Reddington 27 Jul. 1979 40 p refs
(Grant AF-AFOSR-3616-78; AF Proj. 2302)
(AD-A074177; AFOSR-79-0950TR) Avail: NTIS HC A03/MF A01 CSCL 11/9

Infrared matrix-isolation spectra of HF and HF/H2O mixtures suspended in solid argon have been obtained in the range 1/400-4000 cm. Bands attributed to HF and to HF-H2O oligomers were observed. HF stretching modes were assigned to dimer, chain trimer, cyclic tetramer, and cyclic hexamer of HF. Some of the FH..F angle deformation modes were observed for these molecules. The oligomers are formed during matrix deposition and the chain trimers appear to be matrix stabilized in a double substitution site in argon. Application of a nonideal gas model to the literature vapor phase data on HF suggests that the dimer and the hexamer are the dominant vapor phase oligomers, with the hexamer most important near saturation vapor pressures. The tetramer is the next most important vapor phase oligomer, but it contributes only weakly to the vapor phase properties. Minimal basis set STO-3G computations on chain and cyclic HF trimer and tetramer molecules suggest the marked increase in stability that arises on catenation or (unstrained) cyclization of HF systems. GRA

N80-15269# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
DISPLACEMENT CHARACTERISTICS OF A GLASS-CERAMIC INSULATOR IN A VACUUM TUBE ENVELOPE SEALING PROCESS
R. K. Spears 12 Oct. 1979 16 p
(Contract EY-76-C-04-0656)
(GEPP-TIS-445) Avail: NTIS HC A02/MF A01

The flow characteristics of two glass-ceramic compositions (used for high voltage insulation in a vacuum tube envelope) were examined during sealing to molybdenum by determining the temperature at which the glass starts to flow and the temperature at which it becomes fully deformed. The initial softening temperature was between 630 and 715 C; the deformation temperature ranged from 890 to 1010 C. DOE

N80-15270# Sandia Labs., Albuquerque, N. Mex.
ELECTRICAL ACTIVITY IN SHOCK-LOADED POLYMERS
R. A. Graham 1979 9 p refs Presented at the 7th Intern. AIRAPT Conf., La Creusot, France, 30 Jul. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-0592C; CONF-790709-14) Avail: NTIS HC A02/MF A01

Studies concerning shock-induced conduction and shock-induced polarization phenomena in polymers are summarized and recent results presented. DOE

N80-15271# Ames Lab., Iowa.
PULSE AND MULTIPLE PULSE N.M.R. STUDIES OF CRYSTALLINITY AND MOLECULAR DYNAMICS OF SOLID STATE POLYMERS
Armin James Paff May 1979 64 p refs
(Contract W-7405-eng-82)
(IS-T-860) Avail: NTIS HC A04/MF A01

Pulse and multiple pulse N.M.R. techniques were used to study polypropylene and polyethylene. The degree of crystallinity of two polypropylene samples was investigated by analyzing the time decays of a simple pi/2 pulse and the more complex eight-pulse cycle. The single pulse experiment gives the superposition of two decays, the short component being attributed to the rigid region while the long component to the mobile region. Heating of the samples to 88 C produced a situation where the rigid and mobile regions become synonymous with the crystalline and noncrystalline regions. DOE

N80-15272# California Univ., Livermore. Lawrence Livermore Lab.
ENVIRONMENTALLY ENHANCED CRAZING IN POLYMERS
R. J. Morgan and E. T. Mones 29 Mar. 1979 8 p refs Presented at Am. Chem. Soc. Natl. Meeting, Washington, D.C., 10 Sep. 1979
(Contract W-7405-eng-48)
(UCRL-82488; CONF-790917-2) Avail: NTIS HC A02/MF A01

The effects of low-molecular-weight chemicals on the physical integrity and failure modes of amorphous but crystallizable polycarbonate and crosslinked epoxy glasses are presented. Solvent-induced crystallization (SINC) is shown to play a role in the solvent-crazing mechanism of polycarbonate. A mechanically weak, cavitated, crazed surface layer is produced in polycarbonate as a result of a combination of volume decreases caused by SINC and liquid-induced dilational swelling stresses together with the relaxation of fabrication stresses. The mechanism by which surface crazing in polycarbonate is enhanced by handling is also reported. In the epoxy studies, sorbed moisture plasticizes these crosslinked glasses and causes their mechanical properties to deteriorate. Studies of the initiation cavity and mirror regions of the fracture topographies of these epoxies indicate that sorbed moisture enhances the craze initiation and propagation processes. DOE

N80-15273# Sandia Labs., Albuquerque, N. Mex.
SYNTHESIS AND CHARACTERIZATION OF NEW POLYETHER BASED SOLUBLE POLYURETHANES
J. A. Wagner and C. Arnold, Jr. 1979 8 p refs Presented at the Am. Chem. Soc. Natl. Meeting, Washington, D.C., 10 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-78-1866C; CONF-790917-3) Avail: NTIS HC A02/MF A01

A removable material which would have properties similar to crosslinked, insoluble encapsulants but allow rework capability was developed. A series of polyether-based soluble polyurethanes was synthesized and a number of mechanical and electrical properties were measured. The polyurethanes were formulated using bitolylene diisocyanate polytetramethylene ether glycol (several molecular weights were tried) and two different diols. A number of formulations were tried and efforts concentrated on the two most promising materials. Since it was determined that the cure was not complete after the standard length of time (16 hours, verified by an isocyanate absorption in the infrared scan at 2280/cm), a post cure of sixteen hours was carried out. DOE

N80-15274# National Technical Information Service, Springfield, Va.
HIGH TEMPERATURE LUBRICANTS AND OILS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Aug. 1979
Diane M. Cavagnaro Oct. 1979 234 p Supersedes NTIS/PS-78/0948; NTIS/PS-77/0861
(NTIS/PS-79/1032/6; NTIS/PS-78/0948; NTIS/PS-77/0861) Avail: NTIS HC $28.00/MF $28.00 CSCL 11H

This bibliography of worldwide research citations discusses the properties, uses, composition, performance, and wearing ability of hydraulic fluids, oils, greases, and solid lubricants. This updated bibliography contains 226 abstracts, 33 of which are new entries to the previous edition. GRA

N80-15275# National Bureau of Standards, Washington, D.C.
MEASUREMENTS AND STANDARDS FOR RECYCLED OIL - 2
Donald A. Becker, ed. and Helen Anne Hurd Sep. 1979 218 p refs Presented at NBS Conf., Gaithersburg, Md., 29-30 Nov. 1977
(PB-299951/4; NBS-SP-556; LC-79-600126) Avail: NTIS HC A10/MF A01 CSCL 11H

Progress in the development of measurement methods and test procedures, as well as standards, for recycled oil is reported. Areas of legislation which affect the recycled oil program are discussed along with environmental issues. Other topics covered include oil recycled as engine oils, nonlubricating end uses, and additional recycled oil activities. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N80-15276# SRI International Corp., Menlo Park, Calif.
MISSION ANALYSIS FOR THE FEDERAL FUELS FROM BIOMASS PROGRAM. VOLUME 3: FEEDSTOCK AVAILABILITY Final Report
R. K. Ernest, R. H. Hamilton, N. S. Borgeson, F. A. Schooley, and R. L. Dickenson Jan. 1979 79 p refs
(Contract EY-76-C-03-0115)
(SAN-0115-T1) Avail: NTIS HC A05/MF A01

The biomass supply in the United States is estimated through the year 2020. The biomass supply represents the combined tonnages of agricultural, logging, and mill residues, other forest residues, and energy crop output. Two scenarios were used for the projections: a base case and an optimistic case reflecting increases in land and water availability for production of energy crops resulting from an array of government incentives. An appendix tabulates the feedstock availability by region, type, price, year, and scenario. DOE

N80-15277# Puerto Rico Scientific Research Lab., Inc., Rio Piedras. Agricultural Experiment Station.
PRODUCTION OF SUGARCANE AND TROPICAL GRASSES

AS A RENEWABLE ENERGY SOURCE Quarterly Report, 1978 - 1979
A. G. Alexander, M. Garcia, C. Gonzalez-Molina, and J. Ortez-Velez 1979 62 p refs
(Contract ET-78-S-05-5912)
(DOE/CS/5912-T1; QR-2) Avail: NTIS HC A04/MF A01

Candidate grasses were identified for short-rotation crops having potentially greater versatility than Sordan 70A. Field-plot studies were performed on the optimization of N-fertilization and seeding rates for Sordan 70A. Field-plot data were recorded on sugarcane and napier grass responses to harvest frequency and row spacing. These results underscore a superiority of first-ratoon yields over plant-crop yields, of napier grass over sugarcane (up to 4 months), and delayed harvests over frequent harvests. Breeding tests were successful in producing F1 seedlings from crosses between an unknown and early-tasseling wild S. Spontaneum hybrid and late-tasseling commercial sugarcane hybrids. DOE

N80-15278# Institute of Gas Technology, Chicago, Ill.
LNG INDUSTRY: AN OVERVIEW OF PROJECTS AND COSTS
J. Glenn Seay, Philip J. Anderson, and Edward J. Daniels 1978 29 p Presented at ASME Energy Tech. Conf., Houston, Tex., 5 Nov. 1978
(Contract EE-76-C-02-4234)
(CONF-7811112-2) Avail: NTIS HC A03/MF A01

A summary of the LNG projects that are currently in various stages of development is presented. These projects account for a potential international LNG trade of about 765 million cu m (27 billion CF) per day. The operating experiences of some of the currently operational projects are reviewed with an emphasis on the natural gas liquefaction facilities. DOE

N80-15279# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
PROJECT PLANNING DOCUMENT: HIGHWAY VEHICLE ALTERNATIVE FUELS UTILIZATION PROGRAM (AFUP)
Jul. 1979 66 p
(DOE/CS-0093) Avail: NTIS HC A04/MF A01

Criteria and guidelines for the evaluation and development of nonpetroleum based highway vehicle fuels derived from domestic resources are developed. Five basic classes of alternative fuels are presented. Within each class, general areas of R & D that were addressed are illustrated in terms of a matrix format, while specific project relationships are identified by a corresponding flow chart. An overview of the evaluation of and relationships between these several alternative fuels classes intended to progress toward a uniform and independent domestic highway transportation system is presented. The mechanism for implementation is outlined. DOE

N80-15280# Department of Energy, Washington, D. C.
ETHANOL/GASOLINE BLENDS AS AUTOMOTIVE FUELS
J. R. Allsup and D. B. Eccleston 1979 13 p refs Presented at the 3rd Intern. Alcohol Fuels Technol., Asilomar, Calif., 28 May 1979
(CONF-790520-5) Avail: NTIS HC A02/MF A01

An experimental study of gasoline and 10% ethanol/90% gasoline blends was made using five late-model vehicles operated on a climate controlled chassis dynamometer. Data were obtained to permit comparisons of fuel economy, emissions, and other significant operational characteristics observed in tests with the two fuels. Volumetric fuel economy was shown to be slightly decreased, while energy economy was slightly increased using the ethanol/gasoline blend. Compared with the results using base gasoline, the use of the ethanol/gasoline blend had no adverse effect upon regulated emissions at test temperatures within the range 20 to 75 F; at 100 F there were mirror increases in emissions using the ethanol/gasoline blends. DOE

N80-15281# Argonne National Lab., Ill.
ENVIRONMENTAL PLANNING AND ASSESSMENT FOR HIGHWAY VEHICLE USE TO ALCOHOL FUELS
M. J. Bernard, III and O. M. Bevilaqua 1979 12 p refs Presented at 3d Intern. Alcohol Fuels Technol., Asilomar, Calif., 28 May 1979
(Contract W-31-109-eng-38)
(CONF-790520-2) Avail: NTIS HC A02/MF A01

The DOE environmental evaluation process designed to implement the National Environmental Policy Act policies and guidance is presented. In particular, it focused on that process as it is being used for DOE's alcohol fuels project within the Office. DOE

N80-15282# California Univ., Livermore. Lawrence Livermore Lab.
SIMULATION OF LNG VAPOR SPREAD AND DISPERSION BY FINITE ELEMENT METHODS
S. T. Chan, P. M. Gresho, and R. L. Lee Jul. 1979 36 p refs Presented at Natl. Conf. on Numerical Methods in Heat Transfer, College Park, Md., 24 Sep. 1979
(Contract W-7405-eng-48)
(UCRL-82441; CONF-790915-1) Avail: NTIS HC A03/MF A01

Two finite element models (one based on solving the time dependent, two dimensional conservation equations of mass, momentum, and energy, with buoyancy effects included via the Boussinesq approximation; the other based on solving the otherwise identical set of equations except using the hydrostatic assumption) are described and applied to predict some aspects of the vapor dispersion phenomena associated with liquefied natural gas (LNG) spills. A number of controlled numerical experiments, representing a reasonable expected range of LNG spill scenarios and atmospheric conditions, were carried out. Data regarding the applicability and limitations of the hydrostatic assumption for predicting LNG vapor spread and dispersion are established on comparing the results obtained with these finite element models. DOE

N80-15283# Natural Dynamics, Des Moines, Iowa.
FAST PRODUCTION OF METHANE BY ANAEROBIC DIGESTION. VOLUME 2: APPENDICES Final Report, 24 May 1976 - 31 Dec. 1978
C. D. Finney, R. S. Evans, II, and K. A. Finney Dec. 1978 174 p
(Contract EY-76-C-02-2900)
(COO-2900-17-Vol-2) Avail: NTIS HC A08/MF A01

The following are appended: (1) data from the system containing the digesters; (2) thermophilic temperature experiments; (3) agitational experiments; (4) data from the pressure experiment; (5) a body of data taken on a second digestion system for a loading experiment conducted under conditions of elevated temperature, reduced pressure, and vigorous agitation; and (6) the conversion of RDF to soluble COD. DOE

N80-15284# Colorado Energy Research Inst., Golden.
HYDROGEN AND METHANE SYNTHESES THROUGH RADIATION CATALYSIS Progress Report, 1 Jun. 1977 - 31 Aug. 1978
J. G. Morse Sep. 1978 149 p refs
(Contract EG-77-C-02-4258)
(COO-4258-1) Avail: NTIS HC A08/MF A01

Preliminary testing was performed of the concept of an electronic theory of catalysis to relate electrical properties of the catalysis to increased rates in radiation-induced reactions. The first system selected for study was the radiolysis of water as stimulated by absorption of gamma radiation. Early results indicate a significant correspondence between hydrogen gas yield and the forbidden band gap (Eg) of the catalyst substrate, when Eg approximates the energy of the hydrogen-oxygen bond in the water molecule. Catalysts tested were TrO2, SrTr03, Sb203, Mo03, Nb205, SnO2, CaO, HfO2, In203, and V205. Equipment to measure dielectric properties of solids was built and calibrated, and will be applied to pre- and post-irradiation testing of the catalysts used. The appendices review existing analytical models of photoelectrochemical cells and present a theoretical modeling of semiconductor-electrolyte interfaces. DOE

N80-15285# Argonne National Lab., Ill. Reactor Analysis and Safety Div.
LIQUID-LIQUID CONTACT IN VAPOR EXPLOSION Ph.D. Thesis - Northwestern Univ.
A. Segev Aug. 1978 343 p refs
(Contract W-31-109-eng-38)
(ANL/RAS-78-37) Avail: NTIS HC A15/MF A01

A theoretical study was performed to check the possibility

of vapor film squeezing (between a drop in film boiling and a surface) as a controlling mechanism for making liquid-liquid contact. Using experimental data, the film thickness was calculated and it was found to be too thick for any conceivable film rupture mechanism. It was suggested that the coalescence is a two-stage process, in which the controlling stage depends mainly on temperature and surface properties and can be described as the ability of cold liquid to spread on a hot surface. DOE

N80-15286# Brookhaven National Lab., Upton, N. Y.
PROCEEDINGS OF THE HYDRIDE STORAGE RESERVOIR SYMPOSIUM/WORKSHOP
M. J. Rosso, Jr. 1978 79 p refs Symp. held at Upton, N.Y., 20 Jun. 1978
(Contract EY-76-C-02-0016)
(BNL-26523; CONF-7806165) Avail: NTIS HC A05/MF A01

Problems related to hydride reservoir internal engineering design and container materials, hydride bed heat and mass transfer, and the fundamental properties of hydrides, addressed at the workshop are listed. The abstracts of 12 papers delivered are presented. The texts of two papers not delivered are included. These discuss development of low cost nickel-rare earth hydrides for hydrogen storage and an exact solution of diffusion and absorption of hydrogen in uranium followed by fracture of the hydride. DOE

N80-15287# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR RECOVERY OF NATURAL GAS FROM UNCONVENTIONAL SOURCES
J. Ham, S. E. Atkinson, and L. Dewey 1978 90 p refs
(TID-28848-Draft) Avail: NTIS HC A05/MF A01

Tight gas sands and Devonian shale are ready for commercialization, although higher than historical gas prices, improved recovery technology, and an aggressive commercialization program are required to fully develop these resources. Coalbed methane for local (non-pipeline) markets appears ready for commercialization for the local (self-help) industrial or municipal market. Coalbed methane for pipeline markets does not appear ready for commercialization in the near term due to highly uncertain geologic properties, economic uncertainties, perceived safety hazards, and limited interest by mine operators. Geopressured aquifers do not appear ready for commercialization in the near term because of vast geologic, technical, and environmental uncertainties and high production costs. Given a gap in domestic supplies to 6 to 8 Tcf in 1990, gas from the unconventional, domestic sources could fill 3 to 6 Tcf of this gap. DOE

N80-15288# Sandia Labs., Albuquerque, N. Mex.
LOW TEMPERATURE REACTION PATH FOR COAL LIQUEFACTION
M. G. Thomas and R. K. Traeger 1979 14 p refs Presented at the Am. Chem. Soc. Natl. Meeting, Washington, D.C., 10 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0738C; CONF-790917-7) Avail: NTIS HC A02/MF A01

The applicability of advanced, two-stage liquefaction processes which could lead to the development of new, low temperature and pressure liquefaction schemes is evaluated. DOE

N80-15289# Los Alamos Scientific Lab., N. Mex.
NEW HEAT TRANSFER GEOMETRY FOR HYDRIDE HEAT ENGINES AND HEAT PUMPS
W. A. Steyert Jul. 1979 7 p refs
(Contract W-7405-eng-36)
(LA-7822) Avail: NTIS HC A02/MF A01

A porous metal hydride ($LiNi_5H_6$) composite is presented that provides both mechanical stability to hydride beds and excellent heat transfer to the hydride when used in the appropriate configuration. DOE

N80-15290# Department of Energy, Washington, D. C.
REPORT OF THE ALCOHOL FUEL POLICY REVIEW
Jun. 1979 117 p
(DOE/PE-0012) Avail: NTIS HC A06/MF A01

Policy studies were conducted to assess the potential of alcohol fuels as an alternative source of energy. The conclusions of the analysis are summarized and recommendations to stimulate the use of alcohol fuels from renewable resources are presented, including major policies that the President has endorsed. R.E.S.

N80-15291# Arizona State Univ., Tempe. College of Engineering and Applied Sciences.
CONVERSION OF CELLULOSIC AND WASTE POLYMER MATERIAL TO GASOLINE
J. L. Kuester 28 Mar. 1979 52 p refs
(CDO-2982-3B) Avail: NTIS HC A04/MF A01

The present status and future plans for a project to convert cellulosic (biomass) and waste synthetic polymer materials to quality liquid fuels is presented. A thermal gasification approach was utilized followed by catalytic liquid fuels synthesis steps. Potential products include a medium quality substitute for natural gas or liquid fuel equivalents of diesel fuel, kerosene or high octane gasoline. The process appears very flexible with regard to ability to handle different sources of feedstock. Results to date indicate quality products can be produced. Product yields need to be improved with the main thrust centered on improvement of pyrolysis gas composition. Other items to be addressed are study of alternate economic feedstocks, waste stream characterization, and liquid fuels synthesis and tailoring with particular attention on the effects of alternate feedstocks. A description of a proposed 10 ton/day pilot plant is presented with flow sheet, material balance and cost estimates. DOE

N80-15292# California Univ., Livermore. Lawrence Livermore Lab. Dept. of Chemistry and Materials Sciences.
CRYOGENIC HYDROGEN DATA PERTINENT TO MAGNETIC FUSION ENERGY
P. C. Souers 15 Mar. 1979 90 p refs
(Contract W-7405-eng-48)
(UCRL-52628) Avail: NTIS HC A05/MF A01

The measured physical and chemical properties of the hydrogens below 30 K were analyzed and correlated. Properties are estimated for deuterium--deuterium tritide--tritium (D2-DT-T2) fusion fuel. DOE

N80-15293# Oregon State Univ., Corvallis.
INVESTIGATION OF THE VIABILITY AND COST EFFECTIVENESS OF SOLID FUEL GASIFIERS CLOSE COUPLED TO INTERNAL COMBUSTION ENGINES FOR 200 kWe POWER GENERATION Progress Report
J. G. Mingle and D. C. Junge Jan. 1979 52 p refs
(Contract EY-76-S-06-2227)
(DOE/RL-90476-13; PR-9; RLO-2227-T22-13) Avail: NTIS HC A04/MF A01

The viability and cost effectiveness of a 200 kWe engine generator unit fueled by a direct coupled, solid fuel gasifier were studied. Fuel and gasifier technology, gas treatment (clean up) for engine use, engine use technology, other uses for gasifiers, the viability of close coupled units, and an estimate of cost effectiveness are discussed. Present small experimental gasifier systems were found to perform as expected and have served to demonstrate the technology. Certain needed development efforts are discussed. DOE

N80-15294# TRW Defense and Space Systems Group, Redondo Beach, Calif.
COAL SULFUR MEASUREMENTS Final Report, Jan. 1976 - Dec. 1978
J. W. Hamersma and M. L. Kraft Jul. 1979 76 p refs
(Contract EPA-68-02-2165)
(PB-299575/1; EPA-600/7-79-150) Avail: NTIS HC A05/MF A01 CSCL 08I

A technique for sulfur forms analysis based on low temperature oxygen plasma ashing is presented. It involves analyzing the low-temperature plasma ash by modified ASTM techniques after selectively removing the organic material. The procedure was tested on 25 coals and compared with ASTM analyses with excellent results. A separate set of experiments showed that it is also feasible to determine organic sulfur directly by trapping SOx in the plasma ash effluent. GRA

N80-15295# National Bureau of Standards, Boulder, Colo. Thermophysical Properties Div.
ISOBUTANE: PROVISIONAL THERMODYNAMIC FUNC-

TIONS FROM 114 TO 700 K AT PRESSURES TO 700 BAR

Robert D. Goodwin Jul. 1979 192 p refs
(PB-299361/6; NBSIR-79-1612) Avail: NTIS HC A09/MF A01 CSCL 07D

The pure component of LNG, namely methane, ethane, propane, n-butane, and isobutane were analyzed. Thermophysical properties of isobutane are tabulated at integral temperatures along isobars over the entire range of fluid states. Results for the compressed liquid, from the triple- to the boiling-point, were estimated by use of the highly constrained, nonanalytic equation of state, because experimental P-rho-T data are lacking in this region. GRA

N80-15296# Purdue Univ., Lafayette, Ind. School of Materials Engineering.

SULFUR FIXATION DURING COAL GASIFICATION Final Report, 1 Mar. 1975 - 28 Feb. 1978

R. Schuhmann, Jr., R. H. Spitzer, and A. J. Mehta 15 Dec. 1978 107 p refs
(Grant NSF AER-75-02665)
(PB-301104/6; PRF-8601) Avail: NTIS HC A06/MF A01 CSCL 07A

The development of basic engineering data for design of a coal gasification process in which the sulfur is fixed and separated in chemical combination with iron is reported. Results of thermodynamic calculations and phase equilibrium studies conducted for the ternary condensed systems Fe-O-S and Fe-C-S, and for equilibria of condensed phases in these systems with gases containing various combinations of C, O, H, and S are given. It is shown that iron oxides, metallic iron, and iron silicates should be effective sulfur fixation agents over wide ranges of gas compositions and gasification temperature, both below and above the melting point of iron sulfide. GRA

N80-15297# Texas A&M Research Foundation, College Station. Dept. of Chemical Engineering.

CONVERSION OF COAL-BASED METHANOL TO ETHYLENE AND A GASEOUS FUEL Final Report, 1 Oct. 1975 - 30 Sep. 1978

Rayford G. Anthony 1 Dec. 1978 47 p ref
(Grant NSF AER-74-20135)
(PB-301256/4; NSF/RA-780616) Avail: NTIS HC A03/MF A01 CSCL 07A

Development of a catalytic process which converts methanol into ethylene and a gaseous fuel similar to natural gas is reported. An AW500 type catalyst proved to be the best catalyst for converting methanol into ethylene, 80 to 98 percent of the alcohol being converted into 16 to 60 percent yields of ethylene. Coal-based methanol was converted into a gaseous mixture composed of 50 percent dimethyl ether, 33.3 percent hydrogen and 16.7 percent carbon monoxide by passing the alcohol over alumina and zinc chromite catalysts at 300-500 C. The major cost of producing ethylene or gaseous fuel is the initial cost of synthesis gas produced from coal that is subsequently used to produce methanol. GRA

N80-15298# New Mexico Energy Inst., Las Cruces.

ECONOMIC ANALYSIS OF SMALL SCALE BIOCONVERSION UNITS IN NEW MEXICO Final Report, 1 Sep. 1977 - 31 May 1979

Wendell Hull and Eugene E. Staffeldt Jun. 1979 156 p refs
(Contract EMD-77-2202)
(PB-301390/1; NMEI-37) Avail: NTIS HC A08/MF A01 CSCL 21D

Three New Mexico agribusinesses were analyzed to find an economic method for converting biomass from agricultural sources to methane. Primary design goals were simplicity, least-cost construction, and safe operation. Two basic digestion systems were designed. They vary only in digester vessel and related component size, not in operation. Each system was evaluated with respect to cost and operational characteristics. Recommendations are given for each business studied. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-15299*# Old Dominion Univ. Research Foundation, Norfolk, Va.

SOIL ANALYSES AND EVALUATIONS AT THE IMPACT DYNAMICS RESEARCH FACILITY FOR TWO FULL-SCALE AIRCRAFT CRASH TESTS Final Report, 24 May - 31 Aug. 1977

Robert Y. K. Chang Dec. 1977 36 p refs
(Contract NAS1-14193)
(NASA-CR-159199) Avail: NTIS HC A03/MF A01 CSCL 08M

The aircraft structural crash behavior and occupant survivability for aircraft crashes on a soil surface was studied. The results of placement, compaction, and maintenance of two soil test beds are presented. The craters formed by the aircraft after each test are described. J.M.S.

N80-15300*# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.

DIRECTIONAL SOLIDIFICATION AT ULTRA-HIGH THERMAL GRADIENT Final Report

M. C. Flemings, D. S. Lee, and M. A. Neff Jan. 1980 34 p refs
(Grant NsG-3046)
(NASA-CR-159797) Avail: NTIS HC A03/MF A01 CSCL 13H

A high gradient controlled solidification (HGC) furnace was designed and operated at gradients up to 1800 C/cm to continuously produce aluminum alloys. Rubber 'O' rings for the water cooling chamber were eliminated, while still maintaining water cooling directly onto the solidified metal. An HGC unit for high temperature ferrous alloys was also designed. Successful runs were made with cast iron, at thermal gradients up to 500 C/cm. K.L.

N80-15301# California Inst. of Tech., Pasadena.

LEADING EDGE FLUTTER OF A SUPERCAVITATING HYDROFOIL Ph.D. Thesis

Kiam Thian Oey 1979 150 p refs
(Contract N00014-75-C-0379)
(AD-A074636) Avail: NTIS HC A07/MF A01 CSCL 20/4

Leading edge flutter is a problem that is unique to a supercavitating hydrofoil. At high speed, the leading edge portion has been observed to oscillate while the trailing edge remains motionless. In this study, several flat plate hydrofoils were tested. The experimental results indicate that the phenomenon is a complex function of speed, angle of attack, cavitation number and mass ratio. Leading edge flutter was also observed to cause cavity pinching. A theoretical study was also conducted. Two mathematical models are presented here. The first one models the flexible chord foil as a rigid chord foil hinged at the trailing edge; the second model treats the fluid-structure interaction problem of a flexible chord foil cantilevered at the trailing edge. Both models resemble leading edge flutter near zero cavitation number in some respects. At short and moderate cavity lengths, leading edge flutter phenomenon is influenced by the cavity closure condition. GRA

N80-15302# Total Environmental Action, Inc., Harrisville, N.H.

DESIGN OF RESIDENTIAL BUILDINGS UTILIZING NATURAL THERMAL STORAGE Final Report

D. Lewis, C. Michal, and P. Pietz Jun. 1979 239 p refs
(Contract EY-76-C-02-0016)
(DOE/TIC-10143) Avail: NTIS HC A22/MF A01

The technical and economic feasibility of the uses of natural thermal storage NTS in residential construction in the north central and northeast U.S. is examined. For many NTS applications, the percentage savings in heating and cooling are impressive, but the actual value of the energy saved is found to be insufficient to justify the incremental cost of NTS over reasonable levels of insulation and other energy strategies. NTS in the form of modified Trombe walls, when combined with energy conserving construction methods, is found to be an effective, available and marketable

system. A prototypical residence incorporating this NTS system is designed for instrumentation and as a demonstration of NTS principles. Annual space conditioning costs are reduced to one-third of those found in new construction built to current codes, and less than one-fifth the costs found in typical existing homes. DOE

N80-15303# California Univ., Livermore. Lawrence Livermore Lab.
ELASTIC-PLASTIC ANALYSES FOR SEISMIC RESERVE CAPACITY IN POWER PLANT BRACED FRAMES
T. A. Nelson and R. C. Murray 4 Oct. 1978 89 p refs
(Contract W-740$-eng-48)
(UCRL-52614) Avail: NTIS HC A05/MF A01

Elastic and elastic-plastic seismic analyses were conducted on a braced steel frame using eight time-history records. In order to ensure operability, a frame model incorporating a piping system was subjected to the above seismic loadings using elastic analyses. It was found that the piping system components controlled the seismic capacity of the combined structure. The average results show a reserve capacity of 2.6 times the seismic design level. DOE

N80-15304# New Brunswick Electric Power Commission, Fredericton. Commercial Div.
MEASUREMENT OF ENERGY TO HEAT HOUSES: INITIAL STUDY
Verne Ireton 6 Jun. 1979 35 p refs
(PB-299448/2) Avail: NTIS HC A03/MF A01 CSCL 13A

A program of measurement of the energy consumed for residential space heating was instituted during the summer of 1978. It was felt that heat loss calculations are very conservative and that there is a much larger difference between the energy consumed by a combustion system and an electrical system than that calculated by assuming a furnace efficiency' or a 'seasonal performance factor'. The results obtained during the 1978/79 heating season are presented. GRA

N80-15305# Transportation Research Board, Washington, D.C.
PAVEMENT EVALUATION AND OVERLAY DESIGN: A SYMPOSIUM AND RELATED PAPERS
Mohamed Y. Shahin, Michael I. Darter, Starr D. Kohn, W. A. Phang, and Richard A. Weiss 1979 121 p refs
(PB-299896/1; TRB/TRR-700; ISBN-0-309-02848-5; LC-79-18461) Avail: NTIS HC A06/MF A01; Hard copy also available from Transportation Research Board, 2101 Constitution Ave., N.W. Washington, D.C. 20418, HC $6.20 CSCL 13B

Pavement condition ratings and rehabilitation needs are discussed along with pavement overlay design techniques based on layered elastic theory, vibratory nondestructive testing, falling weight deflectometer measurements, visible pavement distress, and road test data. The minimization of reflection cracking in bituminous concrete overlays on portland cement pavements and in asphalt concrete overlays is also discussed. K.L.

N80-15306# Transportation Research Board, Washington, D.C.
QUALITY ASSURANCE: PERFORMANCE, SEALERS AND MATERIALS VARIATION
Richard M. Weed, Davis A. Law, Gerald L. Anania, E. Otte, and S. N. Runkle 1979 28 p refs
(PB-299895/3; TRB/TRR-697; ISBN-0-309-02846-9) Avail: NTIS MF A01; Paper copy available from Transportation Research Board, 2101 Constitution Ave., N.W., Washington, D.C. CSCL 13B

The following topics are discussed: optimum performance under a statistical specification; acceptance sampling of neoprene joint sealers; variations in quality of treated materials arising during construction; and highway quality assurance. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-15307*# Axiomatix, Los Angeles, Calif.
SHUTTLE ORBITER S-BAND PAYLOAD COMMUNICATIONS EQUIPMENT DESIGN EVALUATION Final Report
James C. Springett and Robert G. Maronde 30 Nov. 1979 181 p refs
(Contract NAS9-15792)
(NASA-CR-160438; R7911-4) Avail: NTIS HC A09/MF A01 CSCL 17B

The analysis of the design, and the performance assessment of the Orbiter S-band communication equipment are reported. The equipment considered include: network transponder, network signal processor, FM transmitter, FM signal processor, payload interrogator, and payload signal processor. F.O.S.

N80-15308*# Texas Univ. at Austin. Electrical Engineering Research Lab.
CTS ATTENUATION AND CROSS POLARIZATION MEASUREMENTS AT 11.7 GHz Final Report, 1 Feb. 1978 - 31 Jan. 1979
W. J. Vogel May 1979 138 p refs
(Contract NAS5-22576)
(NASA-CR-159952) Avail: NTIS HC A07/MF A01 CSCL 20N

Attenuation and cross-polarization isolation at 11.7 GHz, measured at Austin, Texas by receiving the circularly polarized emissions from the CTS satellite are presented. A 12 month summary for Feb 78 to Jan 79 is presented. For .016 percent of the time the attenuation was greater than 10 dB, the isolation was less than 21 dB and the rainrate exceeded 55 mm/hr. Ice depolarization was observed frequently. M.M.M.

N80-15309# Texas Instruments, Inc., Dallas.
LIMITED VOCABULARY CONTINUOUS WORD RECOGNITION Final Technical Report, Aug. 1977 - Jan. 1979
Robert L. Davis, Bruce G. Secrest, and Craig J. Cato Griffiss AFB RADC Aug. 1979 121 p refs
(Contract F30602-77-C-0139; AF Proj. 4027)
(AD-A074206; RADC-TR-79-204) Avail: NTIS HC A06/MF A01 CSCL 17/2

The capability of recognizing a limited vocabulary (20 words) from continuous speech, independent of a limited number of speakers was developed. Emphasis was placed on three major areas: (1) high performance, speaker independent, connected digit recognition for syntactically unconstituted digit sequences; (2) clustering algorithms for use in the development of sets of reference patterns for speaker independent word recognition; and (3) automatic enrollment for speaker dependent, connected word recognition for syntactically unconstrained word sequences of 20 words. The program culminated in the installation of the speaker independent, connected digit recognition program on the base installation security system's advanced development model speaker verification system. R.C.T.

N80-15310# Ohio State Univ., Columbus. Electroscience Lab.
ANALYSIS OF WIRE ANTENNAS MOUNTED NEAR OR AT THE EDGE OF A HALF-PLANE
D. M. Pozar and E. H. Newman Aug. 1979 51 p refs
(Grant DAAG29-76-G-0331)
(AD-A074450; ESL-784569-9; ARO-14012.5-EL) Avail: NTIS HC A04/MF A01 CSCL 09/5

The problem of a monopole antenna mounted near or at the edge of a half-plane is solved using a hybrid moment method solution with an integral expression for the exact half-plane Green's function, and by the MM/GTD method. Results are presented for input impedance of a lambda/4 monopole vs distance from the half-plane edge, and vs. angle for an edge-mounted antenna. Simple expressions for the surface current density induced on the half-plane are derived and used to synthesize an attachment mode for use with the author's previously developed surface patch moment method solution when a wire is attached at or near an edge of a finite plate. GRA

N80-15311# Ohio State Univ., Columbus. Electroscience Lab.
POWER OPTIMIZATION IN ADAPTIVE ARRAY: A TECHNIQUE FOR INTERFERENCE PROTECTION
R. T. Compton, Jr. Jul. 1979 32 p refs

(Contract N00019-79-C-0281)
(AD-A074429; ESL-711847-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report describes a weight control algorithm that may be used in a 2-element adaptive array to protect a desired signal from an interference signal. The algorithm is a constrained gradient technique that either maximizes or minimizes array output power. It is shown that by choosing appropriately between minimization and maximization, a useful desired signal-to-interference-plus-noise ratio can be maintained at the array output over a wide range of signal powers. GRA

N80-15312# Naval Weapons Center, China Lake, Calif.
SYNTHESIS OF SPREAD SPECTRUM SIGNALS FROM THE NON-BINARY GALOIS FIELD
W. O. Alltop May 1978 40 p refs
(AD-A074604; GIDEP-E117-0706; NWC-TM-3475) Avail: NTIS HC A03/MF A01 CSCL 09/4

Maximal linearly recurring sequences over GF(p) are used to construct periodic, polyphase, spread spectrum signals, for p any odd prime. Sequences over GF(q), where q is a power of p, are also employed in the synthesis of pairs and triples of orthogonal signals. The orthogonal signals are ternary, utilizing the two phases 0 and pi as well as intervals of shutdown. Spectral properties of the ternary codes are discussed. The difficulties of high-speed generation of linear sequences for odd primes are also presented. Although the linear sequences over GF(p) have been known for at least four decades, they have not yet been as well exploited in signal design as have binary sequences. GRA

N80-15313# Naval Postgraduate School, Monterey, Calif.
DESIGN OF THE DIGITAL CONTROL AND TEST UNIT SUBSYSTEMS FOR A SATELLITE SIGNAL ANALYZER M.S. Thesis
Clyde Musgrave Jun. 1979 143 p refs
(AD-A073928) Avail: NTIS HC A07/MF A01 CSCL 09/5

The Satellite Signal Analyzer (S.S.A.) will provide Real Time Spectrum Analysis of Communication Satellite UHF Signals. This thesis documents the digital control and test unit subsystems of this S.S.A. The digital control subsystem was designed and built to interface the PDP 11/34 MINICOMPUTER to all digitally controlled devices within the system. The control bus (CIB) provides 32 BITS of digital control on a single board. The TEST UNIT subsystem was designed and built to provide the capability to monitor various signals within the S.S.A. as well as conduct self-checks. The TEST UNIT is capable of measuring the Noise Figure/Temperature of the system receivers, monitoring the level and frequency of system signals, injecting signals into the receivers and transmitting signals to satellites. GRA

N80-15314# Naval Postgraduate School, Monterey, Calif.
NARROWBAND VOICE SYSTEM M.S. Thesis
Raymond Roy Hitchcock Jun. 1979 65 p refs
(AD-A074445) Avail: NTIS HC A04/MF A01 CSCL 09/4

The problem of how to accommodate more simultaneous users in a given bandwidth communications channel was examined. It was determined that voice signals could be reduced in bandwidth by 50 percent. Two speech formants, F1 and F3, were filtered from the speech signal and frequency translation performed to form a compact audio signal. At the receiver this process is reversed and the formants returned to their normal spectral positions. Intelligibility scores of 94 percent were obtained in a listening test conducted using the two formants F1 (250-650 Hz) and F3 (1950-2450 Hz). GRA

N80-15315# ITT Defense Communications Div., Nutley, N.J.
PHASED ARRAY ANTENNA AMPLIFIER EXPLORATORY DEVELOPMENT MODEL Final Report, Jun. 1977 - Jun. 1979
P. Muscianesi, J. Irvine, and J. Ranghelli Fort Monmouth, N.J. Army Communications Research and Development Command Aug. 1979 325 p
(Contract DAAB07-77-C-0146; DA Proj. 1L7-62701-AH-92)
(AD-A074961; CORADCOM-77-0146-F) Avail: NTIS HC A14/MF A01 CSCL 09/5

This final report describes the design characteristics and test results of a scale model (mechanically steerable) Phase Array Antenna Amplifier. As a result of this development investigation, a design approach for a 1 KW system is presented. This report is prepared in two parts. The first part describes the development effort for the scale model system including specifications, design details, photographs, system diagram, test results, and trade off analyses. The second part of this report covers the design approach selected for a 1 KW system. This design approach is based upon the technical accomplishments resulting from the scale model development. GRA

N80-15316# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.
SHOCK PROPAGATION IN THE THREE-DIMENSIONAL LATTICE, 2. METHOD OF CALCULATION
John D. Powell Jun. 1979 61 p
(DA Proj. 1L1-61102-AH-43)
(AD-A074263; AD-E430290) Avail: NTIS HC A04/MF A01 CSCL 20/11

A computer-molecular-dynamic (CMD) technique for simulating shock propagation in a three-dimensional, face-centered-cubic lattice has been developed. The first report in this sequence described the model used and the results of the calculation. This report contains the details of the calculation, a listing of the computer code, definitions of major symbols, and a brief description of the subprograms. GRA

N80-15317# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
THE USE OF CLASSIFIERS AND MICROPROCESSORS FOR TARGET IDENTIFICATION ON USING MILLIMETER WAVE SIGNATURES
P. Martin Alexander Apr. 1979 50 p refs
(AD-A074840; DRDMI-T-79-50) Avail: NTIS HC A03/MF A01 CSCL 09/2

The problem of implementing three basic classification techniques for target acquisition in millimeter wave guided weapon systems is discussed in this report. The three classifiers are: (1) the maximum likelihood classifier, (2) the nearest neighbor classifier, and (3) the linear classifier. The mathematics of each classifier is explicitly delineated in order to assess memory storage and computation load requirements. Using these results, the applicability of microprocessors for implementing these classifiers into fieldable systems is considered. It is shown that the classifiers are easily adaptable to experimental target signatures and that the use of microprocessors is requisite. GRA

N80-15318# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE, 23 APRIL - 2 SEPTEMBER 1978
Robert P. Pagliarulo, John P. Turtle, John E. Rasmussen, Wayne I. Klemetti, and Robert L. Cooley Mar. 1979 90 p refs
(AF Proj. 4600)
(AD-A074762; RADC-TR-79-100) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplementary information. GRA

N80-15319# Physics International Co., San Leandro, Calif.
PULSER FOR VERTICALLY POLARIZED DIPOLE FACILITY (VPD-2) Final Report
Jul. 1979 83 p ref
(Contract F29601-76-C-0048; AF Proj. 1209)
(AD-A074838; AD-E200365; PI-FR-900; AFWL-TR-78-243) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report will provide an outline of the pulser system design features and will give an account of both the factory and site acceptance test procedures and results. During the testing periods certain modifications were found to be necessary in order to improve the performance. These modifications are described. Ultimately, a performance limitation was realized when the pulser was operated into the full VPD-II antenna structure, a limitation which could not be removed without a major redesign of the output peaking circuit. This will be discussed in the report summary

and some tentative suggestions for a future-up-grading will be offered. GRA

N80-15320# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
ELECTROMAGNETIC TRANSMISSION THROUGH AN ANNULAR APERTURE IN AN INFINITE CONDUCTING SCREEN
Chung-Chi Cha and Roger F. Harrington Sep. 1979 93 p refs
(Contract N00014-76-C-0225)
(AD-A074831; TR-79-11) Avail: NTIS HC A05/MF A01 CSCL 20/14

Electromagnetic transmission through an annular aperture in an infinite conducting screen of zero thickness is investigated. The circular aperture is included as a special case. The fields on both sides of the screen are obtained from the free space Green's function by means of the equivalence principle and image theory. An integral equation for the equivalent magnetic current in the aperture is established by enforcing the continuity of the tangential components of both the electric and the magnetic field. This integral equation is solved by the method of moments to obtain the magnetic current, from which other transmission characteristics are obtained. GRA

N80-15321# Air Force Weapons Lab., Kirtland AFB, N. Mex.
ELECTROMAGNETIC PULSE INTERACTION NOTES: EMP 3-39 Final Report
Carl E. Baum Jul. 1979 416 p refs Sponsored in part by DOE
(AF Proj. 9996)
(AD-A074265; AD-E200353; AFWL-TR-79-402) Avail: NTIS HC A18/MF A01 CSCL 20/14

This is a series of notes on electromagnetic pulse interaction. Subjects covered are: Electromagnetic Penetration Through a Circular Aperture in a Plane Screen Separating a Conducting Medium and a Nonconducting Medium; Small Aperture on a Multiconductor Transmission Line Filled with Inhomogeneous Dielectrics; On the Electromagnetic Field Excitation of Unshielded Multiconductor Cables; A Coupling Model for a Pair of Skewed Transmission Lines; On the Analysis of General Multiconductor Transmission-Line Networks; Field Excitation of Multiconductor Transmission Lines; Diffraction through a Circular Aperture in a Screen Separating Two Different Media; and The Receiving Properties of the Small Annular Slot Antenna. GRA

N80-15322# RAND Corp., Santa Monica, Calif.
NOMOGRAMS FOR THE CALCULATION OF PROPAGATION EFFECTS ON TACTICAL MILLIMETER WAVE RADIO LINKS Interim Report, 1 Jan. - 1 Jul. 1979
William Solfrey Aug. 1979 36 p refs
(Contract DAAB07-77-C-0142)
(AD-A073900; CORADCOM-77-0142-1) Avail: NTIS HC A03/MF A01 CSCL 20/14

Description of the development and use of nomograms for calculating propagation effects on tactical millimeter-wave radio links are investigated. The principal causes of attenuation in the millimeter-wave band (35-75 GHz) are oxygen absorption, which depends on radio frequency, and rain scattering, which depends on frequency and rain rate. The nomograms display these dependencies and the range equation, and may be used to calculate communication system performance as a function of range, frequency, and rain rate by simply drawing straight lines between scales. Use of the nomograms is illustrated by several worked examples. By following the techniques demonstrated in the examples, the user should be able to solve link performance problems speedily and simply. Author (GRA)

N80-15323# CNR, Inc., Needham, Mass.
HF MODEM EVALUATIONS FOR THE ADVANCED NARROWBAND DIGITAL VOICE TERMINAL (ANDVT) Final Report
David Chase, Phillip A. Bello, Charles Boardman, Leslie Pickering, and Robert Pinto Nov. 1978 129 p
(Contract N00173-78-C-0041)
(AD-A073674) Avail: NTIS HC A07/MF A01 CSCL 17/2

During this program, the specifications for the ANDVT HF modem have been refined and detailed evaluation and simulation of the new technical features within this modem have been conducted. These include a multiple-tone signal detection format with an adaptive threshold, a multiple-tone/multiple-stage Doppler estimation algorithm, a matched filter frame estimation algorithm utilizing PN correlation properties, a low-rate error-correction coding approach for protection of the KG sync sequences, an error-correction coding approach specifically designed to protect the critical speech parameters, use of soft-decision (channel measurement) information obtained from the demodulator, and decision-directed Doppler tracking utilizing information from all data tones. The analytical and simulation results provide the desirable result that the preamble can be successfully received at a lower SNR than is required for the reception of high-quality 2400-b/s digitized voice. GRA

N80-15324# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
METHOD OF OPTIMAL TRUNCATION: A NEW T-MATRIX APPROACH TO ELASTIC WAVE SCATTERING
W. M. Visscher 1979 16 p refs Presented at the Conf. on Focus on the T-Matrix Approach, Columbus, Ohio, 25 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1954; CONF-7906109-1) Avail: NTIS HC A02/MF A01

A family of matrix theories of elastic wave scattering is derived, and one, which is in a certain sense optimal, is developed. The method of optimal truncation (MOOT), results from a minimum principle and is shown to yield a convergent sequence of approximations. Numerical results for scattering cross sections for longitudinal incident waves with ka less than or equal to 10 from fixed rigid obstacles and voids with axial symmetry are obtained using MOOT, and are compared with results of other matrix theories. Shapes considered include spheres, oblate and prolate spheroids, pillboxes, and cones. Convergence is demonstrated. Extension of the method to elastic and fluid inclusions is discussed, as is its application to cracks, which may be accomplished by simulating the crack with an incompletely bonded identical inclusion. Implications of reciprocity and time reversal invariance are discussed. DOE

N80-15325# National Technical Information Service, Springfield, Va.
ANTENNA SIDELOBE AND INTERFERENCE REDUCTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug. 1979
William E. Reed Oct. 1979 171 p Supersedes NTIS/PS-78/0983; NTIS/PS-77/0889; NTIS/PS-76/0776 (NTIS/PS-79/1013/6; NTIS/PS-78/0983; NTIS/PS-77/0889; NTIS/PS-76/0776) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Research covering techniques for sidelobe cancellation and interference rejection is presented. Techniques include signal processing, beam forming, null steering, adaptive systems, phase shifters, element spacing, filters, and electromagnetic absorbing materials. (This updated bibliography contains 163 abstracts, 15 of which are new entries to the previous edition.) GRA

N80-15326# New Mexico Univ., Albuquerque.
HORN ANTENNAS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Aug. 1979
Gerald F. Zollars Oct. 1979 37 p Sponsored by NTIS (NTIS/PS-79/1018/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Citations to the international literature concerning studies of horn antennas are presented. Antenna design, antenna radiation patterns, and antenna feeds are the major topics included. Contains 154 citations. GRA

N80-15327# National Technical Information Service, Springfield, Va.
LIGHT COMMUNICATION SYSTEMS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jun. 1976 - Aug. 1979
William E. Reed Oct. 1979 289 p Supersedes NTIS/PS-78/0873; NTIS/PS-77/0591; NTIS/PS-76/0511; NTIS/PS-75/412

(NTIS/PS-79/0998/9; NTIS/PS-78/0873; NTIS/PS-77/0591; NTIS/PS-76/0511; NTIS/PS-75/412) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

The design, performance, and application of laser, infrared, and visual communication systems are covered in the cited research report. Transmission and equipment studies for space, atmospheric, and underwater light communication are presented. Topics covered include lasers, fiber optics, signal processing, transmission links, and data transmission. This updated bibliography contains 283 abstracts, 52 of which are new entries to the previous edition. GRA

N80-15328# East-West Communication Inst., Honolulu, Hawaii.
SATELLITE TELEVISION IN INDONESIA Final Report, Sep. 1977 - Feb. 1979
Godwin C. Chu Aug. 1979 343 p
(Grant NSF INT-77-15160)
(PB-299524/9; NSF/INT-15160) Avail: NTIS HC A15/MF A01 CSCL 17B

Surveys, program content analysis, and an examination of policy goals and institutional factors, are presented in order to explain the long-term social impact of television in Indonesia. Specific areas covered include cognitive and cultural effects, behavioral effects, intra-institutional relations, and inter-institutional relations. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-15329# Rand Afrikaans Univ., Johannesburg (South Africa). Dept. of Electrical and Electronic Engineering.
AN EXPERIMENTAL STUDY OF THE INSTABILITY OF THYRISTOR CONTROLLED SYSTEMS
A. J. Pienaar Jan. 1977 42 p refs
(RAU-EI-74-2-4; ISBN-0-86970-105-3; RR-77-22) Avail: NTIS HC A03/MF A01

Experimental investigation of the stability of an analog speed control system by means of a controlled thyristor bridge for a 75kW dc-motor is described. State space techniques with pole assignment are used to find a suitable system decription in terms of the motor parameters and gain constants. The method of pulse forming and shifting is described in detail. It is also demonstrated that because of too fast armature current loop, ripple instability results by increasing the gain of the current error amplifier to a critical value. The effect of greater pulse error on the system is shown for continuous and discontinuous armature current. M.G.

N80-15330# Varian Associates, Palo Alto, Calif. Central Research Lab.
INDIUM PHOSPHIDE GUNN DEVICES (26-60GHz) Final Report, 1 May 1977 - 31 Mar. 1979
J. D. Crowley, S. B. Hyder, and B. R. Cairns 15 Aug. 1979 135 p refs
(Contract N00123-77-C-0459)
(AD-A074549; NOSC/TD-275) Avail: NTIS HC A07/MF A01 CSCL 09/5

The program described is directed to the development of InP material and devices for low noise, broad bandwidth amplifier operation in the 26.5 to 40.0 and 40.0 to 60.0 GHz bands. Final objectives are low noise amplifiers covering the 26.5 to 40.0 GHz and low noise amplifiers with bandwidth greater than 10% covering the 40.0 to 60.0 GHz band. GRA

N80-15331# Research Advisory Inst., Inc., South Laguna, Calif.
SUPERCONDUCTING MICROWAVE PULSE AMPLIFIER Final Report
D. L. Birx, G. J. Dick, W. A. Little, J. E. Mercereau, and D. J. Scalapino Jul. 1979 24 p refs
(Contract N00014-75-C-1115)
(AD-A074056; RAI-111) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report summarizes the preliminary research and development of a new and novel technique for very high power microwave pulse amplification. The technique is based on the principle of time compression and is most efficient when utilized in conjunction with superconducting (cryogenic) components. However, it has also been shown to be applicable as a purely ambient temperature device. Very high power microwave pulses appear to be feasible with this technique. GRA

N80-15332# Rome Air Development Center, Griffiss AFB, N.Y.
TWO-POLE VARACTOR-TUNED HELICAL RESONATOR FILTERS Technical Report, Jan. 1977 - Mar. 1979
Martin R. Stiglitz Jun. 1979 21 p refs
(AF Proj. 4600)
(AD-A074476; RADC-TR-79-182) Avail: NTIS HC A02/MF A01 CSCL 09/5

Two-pole varactor-tuned helical resonator filters that operate in the 960 to 1215 MHz band have been designed and built. They exhibit group delays of less than 10 microsec, and can be constructed to have insertion losses of 3 dB or less. Two designs have been investigated, one where both sections of the filter were tuned with a single bias source, and the other where each section was tuned individually. Varactor diodes are sensitive to changes in input power level and they are saturated at rf power levels above 0.3 mW. Tunin- speeds of 10 microsec are possible when care is taken to minimize the inductances in the bias circuits. GRA

N80-15333# Purdue Univ., Lafayette, Ind. Turner Lab. for Electroceramics.
THE EFFECTS OF SUBSTRATE COMPOSITION ON THICK FILM CIRCUIT RELIABILITY Quarterly Report no. 2, 1 May - 31 Jul. 1979
R. W. Vest 31 Aug. 1979 48 p refs
(Contract N00019-79-C-0240)
(AD-A074907; QR-2) Avail: NTIS HC A03/MF A01 CSCL 09/1

Measurements of the high temperature viscosities and surface tensions of thick film glasses, as a function of temperature and amount of AlsiMag 614 substrate dissolved in the glasses, were completed. Both glass properties were observed to increase with increasing amount of dissolved substrate at all temperatures. The non-sintered contacts occurring in the RuO2 networks of thick film resistors were modeled using MIM devices. The dominant charge transport mechanism for glass films ~7nm at room temperature and above was Schottky emission; for thinner films and/or lower temperature, quantum mechanical tunneling becomes important. GRA

N80-15334# Naval Postgraduate School, Monterey, Calif.
GEOMETRIC DESIGN TECHNIQUE FOR TWO-DIMENSIONAL ANALOG AND DIGITAL FILTERS M.S. Thesis
Coskun Zumrutkaya Jun. 1979 154 p refs
(AD-A073963) Avail: NTIS HC A08/MF A01 CSCL 09/3

A technique for the use of semi-infinite planes to approximate the log magnitude versus log frequency characteristics of two-dimensional filters is presented (Extended Bode approach). This technique is applied to quarter plane filters and works well for separable transfer functions. Other non-separable canonic (basic) transfer functions are also studied in terms of their planar approximation. The general technique is shown to be useful for the insight it provides as well as being a simple approach to design. The double bilinear z-transform is studied for use with the two-dimensional analog transfer functions to convert them to the digital domain. GRA

N80-15335# Microwave Associates, Inc., Burlington, Mass.
Ka-BAND MICROWAVE INTEGRATED CIRCUIT SPDT SWITCH DEVELOPMENT Final Report, 11 Sep. 1977 - 30 Jun. 1979
Charles Buntschuh Jun. 1979 83 p refs
(Contract N00173-77-C-0246)
(AD-A074602) Avail: NTIS HC A05/MF A01 CSCL 09/1

The report describes the design and development of Ka-band

(26.5 - 40 GHz) microstrip and finline microwave integrated circuit SPDT switches with drivers. The report describes the plated heat sink PIN diodes and the waveguide to microstrip and fineline transitions used in the designs. Final performance data are presented and compared for both types of switches. It concludes that microstrip is the superior medium for integrated circuit switches. GRA

N80-15336# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
LOW PRESSURE, HIGH VOLTAGE DISCHARGES FOR THE PRODUCTION OF ENERGETIC ELECTRON BEAMS Final Report, 20 May 1975 - 20 May 1979
J. T. Verdeyen Sep. 1979 25 p refs
(Grant DAHC04-75-G-0132)
(AD-A074556; ARO-12528.1-P) Avail: NTIS HC A02/MF A01 CSCL 09/5

The fundamental theories of gas discharges offer widely varying predictions for the relative power input to the negative glow. Calorimetric measurements have been made in a planar helium discharge of the power input to the negative glow relative to the total input power. These measurements show that the limiting efficiency of devices working in this region (e.g., hollow cathode lasers) is approximately 30-40%. To aid in the interpretation of the experimental results a simplified theoretical model was derived. GRA

N80-15337# Harry Diamond Labs., Adelphi, Md.
CHARACTERISTICS OF OROTRON OSCILLATION AND AMPLIFICATION. 1. POWER AND FREQUENCY CHARACTERISTICS
Richard P. Leavitt Jul. 1979 17 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A074761; HDL-TR-1899) Avail: NTIS HC A02/MF A01 CSCL 09/5

Power and frequency characteristics of orotron oscillation and amplification are derived from an equivalent circuit representation of the orotron. Feedback in the orotron (beam bunching) is represented by a negative conductance in parallel with a complex admittance representing the passive open resonator. This system is driven by a current source that represents either noise (Smith-Purcell radiation) in the oscillator mode or an external driver in the amplifier mode. Conditions for excitation of the orotron as an oscillator are derived, and the line width of the output radiation is computed below and above threshold. It is shown that the orotron acts as a linear amplifier below threshold and the product deltaIo(Ap) to 1/2 power remains constant as a function of beam current, where to 1/2 power is the half bandwidth of the device and (Ap) is the small-signal power gain. Amplification characteristics are investigated for excitation by a driver with a finite frequency spread. GRA

N80-15338# Naval Postgraduate School, Monterey, Calif.
AN IN-DEPTH STUDY OF THE SENSITIVITY OF WAVE DIGITAL FILTERS
Masoud Sanaie-Fard Jun. 1979 241 p refs
(AD-A073862) Avail: NTIS HC A11/MF A01 CSCL 09/2

A detailed analytical and experimental study of the sensitivity of Wave Digital Filters has been conducted. The results indicate that the wave digital filter tends to achieve the same low *sensitivity characteristic as the analogue circuit from which it* was derived. Other results indicate relatively higher sensitivity to terminating resistance values compared with internal element values, lower sensitivity for algorithms derived from simple rather than multiple elements, and higher sensitivity at the critical frequencies. Finally the rms error due to the quantization in the number of bits in the multiplier coefficients has been measured at approximately 3 db per bit for the many examples tested. GRA

N80-15339# Naval Ocean Systems Center, San Diego, Calif.
SPECTRAL, FAR-FIELD, AND NEAR-FIELD MEASUREMENTS OF FIVE LIGHT-EMITTING DIODES Progress Report, Apr. - May 1979
C. R. Zeisse and S. A. Miller Jul. 1979 50 p
(AD-A074517; NOSC/TD-265) Avail: NTIS HC A03/MF A01 CSCL 09/1

Contents: Spectral Measurement; Far-Field Measurements; Near-Field Measurements; Appendix A: Geometry of the Far-Field Goniometer; Appendix B: Coordinate System for Far-Field Gray Scale and Contour Representations. GRA

N80-15340# Spire Corp., Bedford, Mass.
RESEARCH ON LOW TEMPERATURE, DIRECTED ENERGY PROCESSING OF VERY LARGE SCALE INTEGRATED STRUCTURES Semiannual Report, 1 Jan. - 30 Jun. 1979
Anton Greenwald Jul. 1979 60 p refs
(Contract MDA903-79-C-0212; ARPA Order 3713)
(AD-A074127; SAR-79-10065-01) Avail: NTIS HC A04/MF A01 CSCL 09/1

The goal of this research program is to demonstrate processing techniques which can eliminate the need for high temperature thermal cycling of silicon wafers in fabricating very large scale integrated (VLSI) devices. Maintaining low temperatures for all processing reduces plastic deformation, diffusion and autodoping problems which would limit the application of submicron geometry design rules. Pulsed electron beam surface heating of the top micron of material is being investigated for annealing of ion-implantation damage and epitaxial regrowth of low temperature chemical-vapor-deposition (CVD) polycrystalline silicon films. Initial research has demonstrated the epitaxial regrowth of 0.3 micron films deposited at 800 C. Annealing of ion-implantation damage typical of buried layer applications has also been demonstrated. Effective uniformity of processing has been improved to + or - 4 percent in one (electron beam) pulse covering the surface of a 3-inch-diameter wafer. Research planned in the next 6 months will stress lower deposition temperatures and pulsed nonmelting techniques for annealing implantation damage. The program is about 2 months ahead of schedule. GRA

N80-15341# Harry Diamond Labs., Adelphi, Md.
A REFLEX TRIODE WITH GEOMETRIC FOCUSSING
Alan Bromborsky, Howard E. Brandt, and R. Alan Kehs Jun. 1979 14 p refs
(DA Proj. 1L1-61102-AH-44)
(AD-A074453; HDL-TM-79-5) Avail: NTIS HC A02/MF A01 CSCL 09/1

Experimental results show that the ion beam generated by a simple reflex triode can be geometrically focussed, yielding an order of magnitude increase in current density (1.1 kA/sq cm) over a comparable nonfocussing triode geometry. Details are given for shaping the anode and cathode surfaces so that significant focussing can be achieved. GRA

N80-15342# Princeton Univ., N. J. Dept. of Electrical Engineering
STUDY OF ELECTRONIC TRANSPORT AND BREAKDOWN IN THIN INSULATING FILMS
Walter C. Johnson 1 Dec. 1978 87 p refs
(Contract DAAG53-76-C-0059; ARPA Order 3466)
(AD-A074457; NVL-0059-009; SATR-6) Avail: NTIS HC A05/MF A01 CSCL 11/6

Recent progress is reported in an ongoing program of studies of high-field effects in thin insulating films on semiconducting substrates. The investigations reported here include further studies of the high-field generation of interface states in the Si-SiO2 system, a comparison between the effects of ionizing radiation and high-field stress in generating interface states in MOS capacitors, and a study of the characteristics of charge trapping in CVD Al2O3 on silicon. GRA

N80-15343# Physics International Co., San Leandro, Calif.
***DEVELOPMENT OF A HIGH-VOLTAGE LINEAR ACTUATOR AMPLIFIER SYSTEM* Final Report**
D. Smart Kirtland AFB AFWL Jul. 1979 200 p
(Contract F29601-77-C-0047; AF Proj. 317J)
(AD-A074266; AD-E200364; PI-FR-1052; AFWL-TR-78-123)
Avail: NTIS HC A09/MF A01 CSCL 20/5

A lightweight, compact, 61-channel linear switching amplifier system has been developed for aircraft use. Each channel accepts input in the + or - 10 V range and outputs + or - 1500 V *into a capacitive load of 0.05 microfarads. The design employs* a system of incremental resonant charging of the load, controlled by a system clock. Internal losses are minimized to hold size *and weight to a minimum. The amplifiers as designed are flat*

in frequency response dc to 400 Hz without slew rate limitation. Linearity is better than 1% full scale. The system is intended to drive piezoelectric actuators of an adaptive optics mirror system. An overall design of the system with computer modeling was completed and a two-channel breadboard was constructed, debugged, and tested. The tests showed that system design requirements were met with only minor deficiencies in maximum voltage and slew rate, correctable with nominal development efforts. GRA

N80-15346# Science Applications, Inc., Berkeley, Calif.
TRANSIENT ANALYSIS OF MULTICONDUCTOR TRANSMISSION LINE NETWORKS: A COMPARISON OF EXPERIMENTAL AND NUMERICAL RESULTS Final Report
S. K. Chang, F. M. Tesche, D. V. Giri, and T. K. Liu Kirtland AFB AFWL Feb. 1979 108 p refs
(Contract F29601-78-C-0002; AF Proj. 3763)
(AD-A074950; AD-E200369; AFWL-TR-78-152) Avail: NTIS HC A06/MF A01 CSCL 20/14

This report computes the transient responses of some multiconductor transmissionline networks, e.g., (a) a three-wire line, (b) a T-network, and (c) an H-network. These computations, which make use of the QV7T computer code were then compared with the available experimentally measured data. Very good agreement was seen between the numerical and experimental results for both pulse and step function driving waveforms. In addition, the transient response of the power cable in the TACAMO aircraft was also computed under certain approximations. The power cable consists of seven wires for the 3-phase power system, and measurements were made earlier on this cable in the ATHAMAS I (HPD) facility at AFWL. Considering all the approximations that had to be made in the numerical computations and the difficulties encountered in the TACAMO EMP testing, the agreement between the calculated and measured responses is seen to be fair. GRA

N80-15345# Los Alamos Scientific Lab., N. Mex.
OVERVOLTAGE PROTECTION BY POINT-PLANE SPARK GAPS
W. R. Scarlett and Kenneth B. Riepe 1979 11 p refs Presented at the Conf. on Electrical Insulation and Dielectric Phenomena, Whitehaven, Pa., 22 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1655; CONF-791028-2) Avail: NTIS HC A02/MF A01

A passive (self-breakdown) point-plane spark gap was developed and successfully used in the Helios power amplifiers which operate at voltages up to 300 kV. A gap of similar design is planned for use in the Antares power amplifiers which operate at 550 kV. These gaps must reliably hold off the normal discharge voltage, but break down with short delay if overvoltaged, diverting the discharge energy to a resistor. A prototype of the Antares gap was built and is undergoing tests. Parameters being investigated include voltage polarity, gap spacing, gas composition, and gas pressure. Results of these measurements and the operational experience of the Helios gaps was presented. DOE

N80-15346# Brookhaven National Lab., Upton, N. Y.
PARTIAL DISCHARGE PERFORMANCE OF LAPPED PLASTIC INSULATION FOR SUPERCONDUCTING POWER TRANSMISSION CABLES AND THE DIELECTRIC STRENGTH OF SUPERCRITICAL HELIUM GAS
A. J. Pearmain (University College, Dublin, Ireland), M. Kosaki (Nagoya Univ., Japan), and R. A. Thomas 1978 11 p refs Presented at Conf. on Elec. Insulation and Dielectric Phenomena, Pocono Manor, Pa., 29 Oct. 1978
(Contract EY-76-C-02-0016)
(BNL-24779; CONF-781027-2) Avail: NTIS HC A02/MF A01

A superconducting power transmission cable was designed using a flexible ac cable with Nb3Sn superconductor force cooled by supercritical helium. A lapped, multilayer plastic tape construction was selected for the electrical insulation with supercritical helium gas filling the butt spaces between tapes. Evaluation of many different tapes showed biaxially oriented laminated polypropylene tape to be a promising dielectric. A series of tests on short samples of insulation wound in a cable-type configuration enabled improvements to be made in screen design and winding techniques. Some partial discharge results from short sample tests are described, and an apparatus with variable electrode spacing developed for studying the effect of electrode material, spacing and area on the breakdown strength of supercritical helium is discussed. DOE

N80-15347# Sandia Labs., Albuquerque, N. Mex.
HIGH CURRENT TESTING OF LIGHTNING ARRESTOR CONNECTORS
E. F. Ehrman Aug. 1979 58 p refs
(Contract EY-76-C-04-0789)
(SAND-74-0326) Avail: NTIS HC A04/MF A01

Simulated severe lightning flash current (approximately 200 kA) testing of lightning arrestor connectors (LAC's) (the MC2796 eighteen pin and MC2797 thirty-two pin) is described. The current generator, electrical circuitry, currents, voltages and test results are discussed. The generator provided 3 components (strokes) with 60 milliseconds between strokes. Fifty LAC's (25 MC2796 and 25 MC2797) were subjected to the tests. The maximum voltage measured at the solder cup terminals of the LAC's was 1325 V which is well within the specified 2000 V limit. The average was 746 V. Melting of the internal parts (web and pins) occurred. Some burning and melting at the mating connector interface was observed. The LAC's functioned as required during exposure to the simulated severe lightning flash current. DOE

N80-15348# Wisconsin Univ. - Madison.
ASSESSMENT OF RESEARCH DIRECTIONS FOR HIGH VOLTAGE DIRECT CURRENT POWER SYSTEMS Quarterly Progress Report, 1 Apr. - 30 Jun. 1979
W. F. Long Aug. 1979 8 p
(Contract ET-78-S-02-5014)
(COO-5014-9) Avail: NTIS HC A02/MF A01

The question of whether a high voltage direct current (HVDC) circuit breaker is needed in the HVDC power system is addressed. The ratings the circuit breaker must have regarding speed of operation, energy absorption, continuous and interrupting current, and voltage are examined. A.W.H.

N80-15349# Illinois Univ., Urbana.
ACTIVATION VOLUMES OF SOME SUPERIONIC CONDUCTORS WITH THE FLUORITE STRUCTURE
J. M. Oberschmidt and D. Lazarus 1979 12 p refs Presented at the Fast Ion Transport in Solids-Electrode and Electrolytes Conf., Lake Geneva, Wis., 21 May 1979
(Contract EY-76-C-02-1198)
(COO-1198-1264; CONF-790538-12) Avail: NTIS HC A02/MF A01

Information about defect and conduction mechanisms of ionic conductors can be obtained by studying the pressure and temperature dependence of the electrical conductivity. The existence of several activated regions of conduction was found. The activation volumes, which are extracted from the pressure data, are small and positive throughout the temperature range investigated. Frenkel defects are dominant up to near the melting points of the materials examined. DOE

N80-15350# Argonne National Lab., Ill.
ANALYSIS OF THE MULTIPHASE INDUCTOR-CONVERTER BRIDGE
Mehrdad Ehsani, R. L. Kustom, and R. E. Fuja 1979 8 p refs Presented at the Pulsed Power Conf., Lubbock, Tex., 12 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-790622-26) Avail: NTIS HC A02/MF A01

Analytical derivations are presented for inductor-converter bridge (ICB) circuits in which energy is transferred from a storage inductor to a load inductor with solid state bridges. These derivations provide complete analytical circuit solution in contrast to previously available numerical (nonanalytical) procedures. The analysis is based on two parallel methods: Fourier expansion of the inverter waveforms; and a novel method based on the inherent waveforms of the ICB, labeled square functions. These analytical values of power flow, inductor currents, and voltages compare favorably with the results of a three-phase ICB experiment at Argonne National Laboratory. DOE

N80-15351# Oak Ridge National Lab., Tenn.
PROPAGATION OF NORMAL ZONES IN THERMALLY INSULATED SUPERCONDUCTORS
Lawrence Dresner 1979 17 p refs Presented at the Cryogenic Eng. Conf., Madison, Wisc., 21 Aug. 1979
(Contract W-7405-eng-26)
(CONF-790815-16) Avail: NTIS HC A02/MF A01

A comparison of measured and calculated propagation velocities for superconductors thermally insulated by silicon grease shows that the grease makes a significant contribution to the effective specific heat of the conductor and substantially reduces the propagation velocity compared with what would be expected for perfectly insulated conductors. DOE

N80-15352# Oak Ridge National Lab., Tenn.
ELECTRIC CHARACTERISTICS OF ION-IMPLANTED LASER-ANNEALED SILICON
R. T. Young, J. Narayan, C. W. White, R. F. Wood, J. W. Cleland, R. D. Westbrook, and P. M. Mooney Aug. 1978 6 p refs Presented at the Conf. on Ion Beam Modification of Mater., Budapest, 4 Sep. 1978 Prepared jointly with the State Univ. of New York, Albany
(Contracts W-7405-eng-26; N00014-75-C-0919)
(CONF-780932-4) Avail: NTIS HC A02/MF A01

The results of electrical measurements on Si implanted with n-type dopants such as P and As and laser annealed are presented. DOE

N80-15353# Stanford Linear Accelerator Center, Calif.
RF POWER SAVING IN LARGE STORAGE RINGS
Z. D. Farkas 15 May 1979 22 p refs
(Contracts EY-76-C-03-0515)
(SLAC-TN-79-2) Avail: NTIS HC A02/MF A01

The application of CARTOP, constant amplitude rf to pulse converter is considered in order to obtain average and peak power gains in large e (+ or -) rings. CARTOP is a scheme where energy storage and modulation converts a continuous radio frequency (rf) wave into periodic rf pulses. A system with CARTOP is shown. The modulated rf goes through an energy storing network that contains at least one energy storing cavity which acts as a flywheel. Between pulses, it takes energy from the klystron and during the pulse it delivers energy to an accelerating cavity. DOE

N80-15354# California Univ., Riverside. Dept. of Physics.
THEORY OF LOW DIMENSIONAL SUPERCONDUCTORS
Biannual Report
E. Simanek Jul. 1979 23 p refs
(Contract EY-76-S-03-0034)
(SAN-0034-T5) Avail: NTIS HC A02/MF A01

The results of works completed during the period June 1, 1977-July 31, 1979 are outlined. The DOE-research project for this period, Theory of Low Dimensional Superconductors, was initiated at the beginning of 1977 in an attempt to explain the anomalies of the behavior of the order parameter in inhomogeneous superconducting films and the nuclear spin relaxation measurements in Al and Sn fine particle samples. Two major contributions emerged out of these efforts. The first is concerned with the calculation of the order parameter in an inhomogeneous superconductor. In the other, a theory of the thermodynamic order parameter fluctuations in small superconducting grains coupled by Josephson coupling was developed. A detailed description of these results is presented. Subsequent efforts were aimed into the area of superconducting alloys with high Kondo temperature such as Al-Mn, Al-V, and Al-Cr. DOE

N80-15355# Sandia Labs., Albuquerque, N. Mex.
SYMPATHETIC BREAKDOWN ON GAPS IN AIR
J. P. Brainard and L. A. Andrews 1979 10 p refs Presented at Conf. on Electrical Insulation and Dielectric Phenomena, Whitehaven, Pa., 21 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0598C; CONF-791028-3) Avail: NTIS HC A02/MF A01

A gap at a distance as great as 0.4 m from an initiating gap was found to sympathetically break down at fields as low as 55 percent of the normal breakdown field. Sympathetic breakdown occurred over a wide range of discharge currents from mA to kA. A relationship between the electric field in a gap and the breakdown initiation time after the introduction of ultraviolet light was determined. DOE

N80-15356# Oak Ridge National Lab., Tenn.
COMPUTATION OF TRANSIENT 3-D EDDY CURRENT IN NONMAGNETIC CONDUCTOR
H. T. Yeh 1978 11 p refs Presented at COMPUMAG Conf., Grenoble, France, 4 Sep. 1978
(Contract W-7405-eng-26)
(CONF-780939-1) Avail: NTIS HC A02/MF A01

A numerical procedure was developed to solve transient three-dimensional (3-D) eddy current problems for nonmagnetic conductors. Integral equation formulation in terms of vector potential is used to simplify the matching of boundary conditions. The resulting equations and their numerical approximation were shown to be singular and to require special handling. Several types of symmetries were introduced. They not only reduce the number of algebraic equations to be solved, but also modify the nature of the equations and render them nonsingular. Temporal behavior was obtained with the Runge-Kutta method. The program is tested in several examples of eddy currents for its spatial and temporal profiles, shielding, boundary surface effects, and application of various symmetry options. DOE

N80-15357# General Dynamics/Convair, San Diego, Calif.
GENERAL DYNAMICS CONVAIR DIVISION APPROACH TO STRUCTURAL ANALYSIS OF LARGE SUPERCONDUCTING COILS
R. W. Baldi 21 Mar. 1979 16 p refs Presented at the Intern. Conf. on Structural Mech. in Reactor Technol., Berlin, 13 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-13975; CONF-790802-31) Avail: NTIS HC A02/MF A01

Integrated procedures developed and applied to analyze large superconducting magnets for nuclear fusion research are examined. Computer programs currently employed to support the analysis phases of the superconducting magnets are described. The computer programs perform a linear elastic, finite element analysis of three dimensional structures and use input data such as coil geometry and specifications, electromagnetic operating forces, and cooldown/warmup temperature gradients. A.W.H.

N80-15358# California Univ., Livermore. Lawrence Livermore Lab.
VERY FAST, HIGH-PEAK-POWER, PLANAR TRIODE AMPLIFIERS FOR DRIVING OPTICAL GATES
M. M. Howland, S. J. Davis, and W. L. Gagnon 12 Jun. 1979 17 p refs Presented at the IEEE Intern. Pulsed Power Conf., Lubbock, Tex., 12-14 Jun. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-82538) Avail: NTIS HC A02/MF A01

A simplified procedure is described for designing very fast pulse amplifiers to drive optical gates within high power Nd:glass laser chains. The use of bridged-T constant resistant networks to transform load capacitance into pure resistance independent of frequency is pointed out. DOE

N80-15359# Oak Ridge National Lab., Tenn.
ANALYSIS AND COMPUTER PROGRAMS FOR EDDY CURRENT COILS CONCENTRIC WITH MULTIPLE CYLINDRICAL CONDUCTORS
C. W. Nestor, Jr., C. V. Dodd, and W. E. Deeds (Tennessee Univ., Knoxville) Jul. 1979 135 p refs
(Contract W-7405-eng-26)
(ORNL-5220) Avail: NTIS HC A07/MF A01

A general derivation is performed to determine the vector potential produced by eddy current coils concentric with multiple cylindrical conductors. The conductors may be inside the coils, encircling the coils, or both. From the vector potential certain physical phenomena, such as coil impedance, mutual coupling between coils, effect of defects, and ohmic heating, are calculated. The coils may be placed in electrical circuits and the voltages produced are calculated. DOE

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N80-15380*# *Arizona State Univ., Tempe.*
MULTIPLE JET IMPINGEMENT HEAT TRANSFER CHARACTERISTIC: EXPERIMENTAL INVESTIGATION OF IN-LINE AND STAGGERED ARRAYS WITH CROSSFLOW *Final Report*
L. W. Florschuetz, D. E. Metzger, D. I. Takeuchi, and R. A. Berry Jan. 1980 86 p refs
(Grant NsG-3075)
(NASA-CR-3217; ERC-R-79034) Avail: NTIS HC A05/MF A01 CSCL 20D

Heat transfer characteristics were obtained for configurations designed to model the impingement cooled midchord region of air cooled gas turbine airfoils. The configurations tested were inline and staggered two-dimensional arrays of circular jets with ten spanwise rows of holes. The cooling air was constrained to exit in the chordwise direction along the channel formed by the jet orifice plate and the heat transfer surface. Tests were run for chordwise jet hole spacings of five, ten, and fifteen hole diameters; spanwise spacings of four, six, and eight diameters; and channel heights of one, two, three, and six diameters. Mean jet Reynolds numbers ranged from 5000 to 50,000. The thermal boundary condition at the heat transfer test surface was isothermal. Tests were run for sets of geometrically similar configurations of different sizes. Mean and chordwise resolved Nusselt numbers were determined utilizing a specially constructed test surface which was segmented in the chordwise direction. R.C.T.

N80-15361*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR GENERATING INPUT FOR ANALYSIS OF IMPINGEMENT-COOLED, AXIAL-FLOW TURBINE BLADE
David Rosenbaum Jan. 1980 57 p refs Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, Ohio
(NASA-TP-1603; AVRADCOM-TR-79-34) Avail: NTIS HC A04/MF A01 CSCL 20D

A computer program, TACTGRID, was developed to generate the geometrical input for the TACTI program, a program that calculates transient and steady state temperatures, pressures, and cooling flows in an impingement cooled turbine blade. Using spline curves, the TACTGRID program constructs the blade internal geometry from the previously designed external blade surface and newly selected wall and channel thicknesses. The TACTGRID program generates the TACTI calculational grid, calculates arc length between grid points required by TACTI as input, and prepares the namelist input data set used by TACTI for the blade geometry. In addition, TACTGRID produces a scaled computer plot of each blade slice, detailing the grid and calculational stations, and thus eliminates the need for intermediate drafting. J.M.S.

N80-15362*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
PRESSURE FLUCTUATIONS ON THE SURFACE OF A CYLINDER IN UNIFORM FLOW
Alfred Ayoub and K. Karamcheti Jun. 1976 121 p refs
(Grants NGR-05-020-676; NsG-2007)
(NASA-CR-162468; SU-JIAA-TR-3) Avail: NTIS HC A06/MF A01 CSCL 20D

The problem of determining the pressure fluctuations induced on the surface of a cylinder by the fluctuating wake behind it is formulated. A formal solution relating the unsteady surface pressure field to the velocity field in the wake is derived and used to obtain general results independent of cylinder shape and Reynolds number. The case of the circular cylinder is then examined in detail. K.L.

N80-15363*# Stanford Univ., Calif.
FULL-COVERAGE FILM COOLING ON FLAT, ISOTHERMAL SURFACES: DATA AND PREDICTIONS *Summary Report*
M. E. Crawford, W. M. Kays, and R. J. Moffat Jan. 1980 116 p refs
(Contract NAS3-14326)
(NASA-CR-3219; SU-HMT-23) Avail: NTIS HC A06/MF A01 CSCL 20D

The heat transfer and fluid mechanics characteristics of full-coverage film cooling were investigated. The results for flat, isothermal plates for three injection geometries (normal, slant, and compound angle) are summarized and data concerning the spanwise distribution of the heat transfer coefficient within the blowing region are presented. Data are also presented for two different numbers of rows of holes (6 and 11). The experimental results summarized can be predicted with a two dimensional boundary layer code, STANCOOL, by providing descriptors of the injection parameters as inputs. J.M.S.

N80-15364*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
COMPUTATION OF THREE-DIMENSIONAL FLOW IN TURBOFAN MIXERS AND COMPARISON WITH EXPERIMENTAL DATA
L. A. Povinelli, B. H. Anderson, and W. Gerstenmaier Jan. 1980 12 p refs Presented at the AIAA Aerospace Sciences Meeting, Pasadena, Calif., 14-16 Jan. 1980
(NASA-TM-81410; E-324) Avail: NTIS HC A02/MF A01 CSCL 20D

A three dimensional, viscous computer code was used to calculate the mixing downstream of a typical turbofan mixer geometry. Experimental data obtained using pressure and temperature rakes at the lobe and nozzle exit stations were used to validate the computer results. The relative importance of turbulence in the mixing phenomenon as compared with the streamwise vorticity set up by the secondary flows was determined. The observations suggest that the generation of streamwise vorticity plays a significant role in determining the temperature distribution at the nozzle exit plane. K.L.

N80-15365*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
NUMERICAL SIMULATION OF SUPERSONIC INLETS USING A THREE-DIMENSIONAL VISCOUS FLOW ANALYSIS
B. H. Anderson and C. E. Towne Jan. 1980 17 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-81411; E-325) Avail: NTIS HC A02/MF A01 CSCL 20D

A three dimensional fully viscous computer analysis was evaluated to determine its usefulness in the design of supersonic inlets. This procedure takes advantage of physical approximations to limit the high computer time and storage associated with complete Navier-Stokes solutions. Computed results are presented for a Mach 3.0 supersonic inlet with bleed and a Mach 7.4 hypersonic inlet. Good agreement was obtained between theory and data for both inlets. Results of a mesh sensitivity study are also shown. K.L.

N80-15366# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
DYNAMICS OF VORTICES AND SHOCK WAVES IN NONUNIFORM MEDIA *Interim Report, 1 Jul. 1978 - 30 Jun. 1979*
B. Sturtevant Jun. 1979 26 p refs
(Contract F49620-77-C-0107; AF Proj. 2307)
(AD-A072842; AFOSR-79-0898TR; GALCIT-134B) Avail: NTIS HC A03/MF A01 CSCL 20/4

The effect of the length of the driver section of the shock tube vortex generator on the properties and behavior of high energy vortex rings with very thin rotational cores was studied. Preliminary results were obtained using ultra-short drivers. A retraction mechanism to rapidly retract the mouth of the tube away from the vortex shortly after it is produced, to aid in the development of vortices generated by the ultra-short drivers, was tested. With this device, the velocity of vortices produced with several different driver lengths was measured. K.L.

N80-15367# JAYCOR, Alexandria, Va.
CONTINUED DEVELOPMENT OF FLUID DYNAMICS MODELS Final Report, 1 Apr. 1978 - 1 Apr. 1979
Philip J. Moffa and Simon W. Chang 6 Apr. 1979 36 p ref
(Contract N00173-78-C-0421)
(AD-A073848) Avail: NTIS HC A03/MF A01 CSCL 20/4

A program of continuing development of several fluid dynamic models has been carried out for NRL by JAYCOR. Specifically, major developments and modifications of several large computer codes have been accomplished. This has been done to provide NRL with an expanded capability of modelling diverse physical phenomena, all of which are amenable to analysis utilizing advanced hydrodynamic computational techniques. GRA

N80-15368# Douglas Aircraft Co., Inc., Long Beach, Calif.
A HIGHER ORDER PANEL METHOD FOR THREE-DIMENSIONAL POTENTIAL FLOW Final Report
John L. Hess Jun. 1979 90 p refs
(Contract N62269-77-C-0437)
(AD-A074751; MDC-J8519; NADC-77166-30) Avail: NTIS HC A05/MF A01 CSCL 20/4

The method described here is a higher-order three-dimensional surface panel method. It utilizes four-sided panels on the actual surface of the body about which flow is to be computed and is thus applicable to arbitrary configurations. In contrast to a first-order panel method that uses flat panels, usually with constant source and/or vorticity density, the present method uses curved panels of second degree with linearly varying source and vorticity density. The mathematical problem solved is that of incompressible potential flow but the calculation can be extended to subsonic flow by means of well-known compressibility corrections. This report presents a discussion of the techniques adopted and some alternatives. A rigorous derivation of the higher-order formulation is carried out. All formulas and logic required by the method are included, except that the report on the corresponding first-order method is relied on for formulas and procedures common to the two techniques. First-order and higher-order calculated results are compared with each other and with exact solutions. GRA

N80-15369# DCW Industries, Studio City, Calif.
DEVELOPMENT OF AN ALTERNATIVE TO THE E9 PROCEDURE FOR PREDICTING BOUNDARY-LAYER TRANSITION Final Report, 15 Sep. 1978 - 14 Mar. 1979
David C. Wilcox Jun. 1979 53 p refs
(Contract N00014-78-C-0799; RR0230183)
(AD-A074071; DCW-R-23-01; ONR-CR-298-005-2F) Avail: NTIS HC A04/MF A01 CSCL 20/4

A method has been devised which can be used in conjunction with linear-stability theory for predicting boundary-layer transition. As with the classical e(9) procedure, for a given frequency, the growth of a disturbance is computed downstream of the initial point of instability using the linearized equations of motion. In contrast to the e(9) procedure in which the linearized equations are used all the way to the inferred transition point, an approximate set of long-time averaged equations which account for nonlinearity is used to describe the ultimate nonlinear growth of the disturbance. Because the new method accounts for nonlinear processes it holds promise as a more physically sound procedure than the e(9) method for determining the point at which a boundary layer undergoes transition to turbulence. GRA

N80-15370# Computational Mechanics Consultants, Knoxville, Tenn.
A NUMERICAL VISCOUS-INVISCID INTERACTION ALGORITHM FOR PREDICTION OF NEAR-FIELD VSTOL JET-INDUCED FLOWFIELDS Final Report, Oct. 1977 - Sep. 1978
A. J. Baker and P. D. Manhardt Feb. 1979 84 p refs
(AD-A074070; NADC-77167-30) Avail: NTIS HC A05/MF A01 CSCL 20/4

A turbulent-inviscid numerical interaction algorithm is derived and evaluated for detailed determination of the near-field flow of a jet injected perpendicular to a crosswind. The two distinct solution domains are pressure coupled through a Poisson equation solution, and entrainment-induced mass flux is an iteration variable. Finite element procedures are employed for solution of the resulting non-linear initial-boundary value equations. Key results are discussed documenting viability for analysis of a round-jet at a velocity ratio equal to eight. GRA

N80-15371# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
NUMERICAL PREDICTION OF FLOWS OVER AND IN THE NEAR WAKE BEHIND AXISYMMETRIC, SELF-PROPELLED BODIES
M. C. Hyman, S. C. Houlihan, J. A. Hill, D. L. Dwoyer, and C. H. Lewis Mar. 1979 72 p refs
(AD-A074971; VPI-AERO-095) Avail: NTIS HC A04/MF A01 CSCL 20/4

A technique is presented for the calculation of laminar, transitional and/or turbulent flows over and in the near wake behind bodies of revolution including the effects of separated flow and an operating propeller. The technique uses an interactive boundary-layer program to obtain a viscous solution over a nonseparating body and to provide upstream boundary conditions for a second program which solves the full Navier-Stokes equations for the propeller, separated flow and near wake regions. The results of calculations made using individual elements of, and the complete system of codes were compared with good agreement against both experimental and numerical data and are included in the present work. GRA

N80-15372# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
USER'S GUIDE FOR A SYSTEM OF COMPUTER PROGRAMS TO PREDICT FLOWS OVER AND IN THE NEAR WAKE BEHIND AXISYMMETRIC, SELF-PROPELLED BODIES
M. C. Hyman, S. C. Houlihan, J. A. Hill, D. L. Dwoyer, and C. H. Lewis Nov. 1978 308 p
(AD-A074972; VPI-AERO-096) Avail: NTIS HC A14/MF A01 CSCL 20/4

A system of computer programs has been developed to predict flows around and in the near wake behind an axisymmetric body including a propeller at the tail of the vehicle. The system is capable of calculating laminar and/or turbulent, attached and separated flows. Interactive boundary-layer theory is used to predict the flow on the nonseparating region over the body and the full Navier-Stokes equations are solved for the separated, propeller and near wake flow regions. Details of the theory and results are included in a separate engineering report. The programs, subroutines, variables in common and input and output data are described. Listings of the program code, input and output data for a sample case are included. GRA

N80-15373# California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Services Div.
FORCED TWO PHASE HELIUM COOLING OF LARGE SUPERCONDUCTING MAGNETS
M. A. Green, W. A. Burns, and J. D. Taylor Aug. 1979 24 p refs Presented at the 21st Cryogenic Eng. Conf., Madison, Wis., 21-24 Aug. 1979
(Contract W-7405-eng-48)
(LBL-9701; CONF-790815-27) Avail: NTIS HC A02/MF A01

The advantages of two phase cooling in many magnet systems are shown. The design of a two phase helium system, with its control dewar, is presented. Pressure drop of a two phase system, stability of a two phase system and the method of cool down of a two phase system are discussed. Included are the results of cool down and operation of superconducting solenoids. DOE

N80-15374# Sandia Labs., Livermore, Calif.
CALCULATION OF PLANE SUDDEN EXPANSION FLOW VIA VORTEX DYNAMICS
W. T. Ashurst Jul. 1979 14 p refs Presented at 2nd Symp. on Turbulent Shear Flows, London, 2 Jul. 1979
(Contract EY-76-C-04-0789)
(SAND-79-8679; CONF-790721-2) Avail: NTIS HC A02/MF A01

The method of discrete vortex dynamics is used to reproduce the flow that occurs in symmetric channels that have sudden expansion. The flow over a single backward facing step is calculated. Detailed comparison with experimental results indicates that the calculated turbulent shear stress depends upon the inlet

shear layer thickness. A calculational shear layer with the experimental thickness results in a recirculation length longer than the experimental value. This is caused by less entrainment across the separated shear layer. The lack of spanwise fluctuations (stream-wise vorticity components) is the cause of reduced entrainment in the two-dimensional calculation when compared to two-dimensional flow experiments. The results show the ability of the discrete vortex dynamic method to simulate turbulent flows. DOE

N80-15375# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Explosives Engineering Div.
VESSEL DISCHARGE BY FRICTION DOMINATED TUBE FLOW
C. S. Landram Jun. 1979 16 p Presented at Gas Dyn. Conf., Livermore, Calif., 22 May 1979
(Contract W-7405-eng-48)
(UCRL-82801; CONF-790583-1) Avail: NTIS HC A02/MF A01

The analytical complexities associated with predicting the discharge of a contained gas from its vessel through a long isothermal tube are simplified. The choking and unchoking temporal regions are shown to be dependent upon the form taken for friction factor, and the solution is therefore shown to depend rather intimately on such forms. Measured and calculated vessel pressure histories are favorably compared for the case of an ideal gas (He) discharging to the atmosphere in laminar flow through a tube of length to diameter ratio 1.2 x 10 to the 4th power. DOE

N80-15376# Argonne National Lab., Ill. Components Technology Div.
NUMERICAL PROCEDURE FOR CALCULATING STEADY/UNSTEADY, SINGLE-PHASE/TWO-PHASE THREE-DIMENSIONAL FLUID FLOW WITH HEAT TRANSFER
V. L. Shah, W. T. Sha, H. M. Domanus, J. L. Krazinski, C. C. Miao, R. C. Schmitt, S. P. Vanka, and S. V. Patankar (Minnesota Univ., Minneapolis) Jun. 1979 89 p refs Prepared for Nucl. Regulatory Comm., Washington, D.C.
(Contract W-31-109-eng-38)
(NUREG-CR-0782; ANL-CT-79-31) Avail: NTIS HC A05/MF A01

A general numerical procedure for the calculation of steady/unsteady, single phase/two phase, three dimensional fluid flow is described. The procedure is based on the control volume approach, which enables the derivation of physically meaningful finite difference equations. The conservation equations employed are based on a two fluid model. Surface permeabilities and volume porosities are included in the finite difference formulations to account for dispersed solid objects in a flow domain. The derivation of the equations and the required iteration scheme are presented, and flow charts are provided for the planning and design of a computer program. DOE

N80-15377# Sandia Labs., Albuquerque, N. Mex.
FLUFLOW: AN APPENDED CODE FOR CALCULATING HEAT TRANSFER TO A FLUID
L. V. Griffith Oct. 1978 23 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8271) Avail: NTIS HC A02/MF A01

The mathematical formulations used in FLUFLOW, a set of subroutines for calculating heat transfer to a fluid, are given. The formulations include a statement of the energy balance and temperature dependent equations for thermal conductivity, specific heat, density, viscosity, pressure drop, friction factors, and Nusselt number. The fluids may be quasi-static or moving at velocities up to Mach numbers around 0.5. Free convection in a quasi-static fluid is calculated with a user-supplied heat transfer coefficient. For a moving fluid, FLUFLOW calculates the heat transfer due to conduction, convection, and advection as a function of the temperature dependent parameters above. DOE

N80-15378# California Univ., Livermore. Lawrence Livermore Lab.
WAVE PROPAGATION IN VISCOELASTIC MEDIA
R. C. Y. Chin 18 Jul. 1979 61 p refs Presented at Intern. School of Physics Enrico Fermi, Varonna, Italy, 23 Jul. - 4 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-83019) Avail: NTIS HC A04/MF A01

The mathematical formulations of the wave propagation problem in a linear viscoelastic solid are reviewed from the point of view of constitutive equations and the theory of linear physical systems. Various general results from the theory of propagating singular surfaces and from the mathematical theory of hyperbolic equations are applied to the analysis of the wave propagation process. The impulse response of three viscoelastic media are analyzed by use of asymptotic methods. The three material models are the standard linear solid, the standard linear solid with a continuous spectrum of relaxation times, and the power law solid. DOE

N80-15379# Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group.
TWO-PHASE VAPOUR-LIQUID FLOW WITH PHASE CHANGE, REVIEW
M. J. Ellman Jul. 1979 96 p refs
(PB-299905; CSIR-CENG-286; ISBN-0-7988-1615-5) Avail: NTIS HC A05/MF A01 CSCL 20D

Theories, models, and measurement techniques for boiling, condensation, or two phase liquid-vapor flow are reviewed. It is recommended that a comprehensive and integrated theory of two phase flow with boiling be developed and that mathematical models be derived which account for phase interactions and which cover the full range of flow regimes. It is also recommended that the parameters involved be evaluated only with the aid of reliable well-documented sets of data and that improved measurement techniques be developed for this field so that data sets can be obtained. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-15380*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
PRESSURE MODULATOR RADIOMETER (PMR) TESTS
E. L. G. Odell, F. M. Cosmi, A. E. Kreft, G. W. Racette, T. J. Maresca, F. O. Pancoast, D. J. Rutecki, and W. C. Yager 25 Sep. 1979 81 p
(Contract NAS1-15044)
(NASA-CR-159175) Avail: NTIS HC A05/MF A01 CSCL 14B

The pressure modulator technique was evaluated for monitoring pollutant gases in the Earth's atmosphere of altitude levels corresponding to the mid and lower troposphere. Using an experimental set up and a 110 cm sample cell, pressure modulator output signals resulting from a range of gas concentrations in the sample cell were examined. Then a 20 cm sample cell was modified so that trace gas properties in the atmosphere could be simulated in the laboratory. These gas properties were measured using an infrared sensor. R.E.S.

N80-15381*# Honeywell Electro-Optics Center, Lexington, Mass.
CLOUD TOP SCANNING RADIOMETER (CTS) Final Report
Jun. 1978 158 p
(Contract NAS5-22459)
(NASA-CR-159954; HONEYWELL-7804-5) Avail: NTIS HC A08/MF A01 CSCL 14B

A scanning radiometer to be used for measuring cloud radiances in each of three spectral regions is described. Significant features incorporated in the Cloud Top Scanner design are: (1) flexibility and growth potential through use of easily replaceable modular detectors and filters; (2) full aperture, multilevel inflight calibration; (3) inherent channel registration through employment of a single shared field stop; and (4) radiometric

sensitivity margin in a compact optical design through use of Honeywell developed (Hg,Cd)Te detectors and preamplifiers.
M.M.M.

N80-15382# Los Alamos Scientific Lab., N. Mex.
PROSPECTS OF USING LARGE VACUUM PHOTODIODES WITH GAS SCINTILLATION PROPORTIONAL COUNTERS
D. F. Anderson 1979 7 p refs Presented at the IEEE Nucl. Sci. Symp., San Francisco, 17 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1246; CONF-791037-1) Avail: NTIS HC A02/MF A01

The use of CsI and Cs2Te as photocathode materials for the detection of ultraviolet light from noble gas scintillators is discussed. Calculated energy resolution for a gas scintillation proportional counter using Cs2Te vacuum photodiodes is compared with the same counter with a photomultiplier tube. Problems which must be solved to permit fabrication of large Cs2Te vacuum photodiodes are mentioned. DOE

N80-15383# Oak Ridge National Lab., Tenn.
LIMITATIONS OF THERMOCOUPLES IN TEMPERATURE MEASUREMENTS
R. L. Anderson, R. K. Adams, and D. C. Duggins 1979 33 p refs Presented at the ISA Intern. Instrumentation Symp., Anaheim, Calif., 7 May 1979
(Contract W-7405-eng-26)
(CONF-790505-14) Avail: NTIS HC A03/MF A01

Factors limiting the accuracy of temperature measurements with type K and type S sheathed thermocouple assemblies are discussed. The effect of short range ordering in Chromel is shown to limit the accuracy of temperature measurements made with type K thermocouple to about 1 percent. Errors of as much as 150 percent were observed in type K thermocouples in magnetic fields at temperatures below the Curie temperature of Alumel. Both positive and negative errors were observed when the orientations of the applied magnetic field, the temperature gradient and the a ,is of the Alumel wire were such as to produce an emf along the thermocouple wire due to the Nernst-Ettingshausen effect. DOE

N80-15384# Idaho National Engineering Lab., Idaho Falls.
PERFORMANCE EVALUATION OF A DRAG-DISC TURBINE TRANSDUCER AND THREE-BEAM GAMMA DENSITOMETER UNDER TRANSIENT TWO-PHASE FLOW CONDITIONS
C. L. Nalezny, L. L. Chen, and C. W. Solbrig (Commonwealth Edison Co., Chicago) 1979 19 p refs Presented at the 2nd Multiphase Flow and Heat Transfer Symp. Workshop, Miami Beach, Fla., 16 Apr. 1979
(Contract EY-76-C-07-1570)
(CONF-790423-15) Avail: NTIS HC A02/MF A01

The transducer combination was performance tested under transient conditions in the blowdown loop. Partial blowdowns of different durations starting from the same initial conditions are included. The reference mean mass flow rate was determined by measuring the amount of water required to reestablish initial conditions after each partial blowdown. The average mass flow rates computed from the output of the drag disc, turbine, and gamma densitometer were compared to the reference mean mass flow rates over three blowdown intervals. Results indicate that the equal phase velocity mass measurement model provided excellent results through the use of the turbine and densitometer, and drag disc and densitometer when the phase velocities were nearly equal. DOE

N80-15385# Brookhaven National Lab., Upton, N. Y.
RESPONSE CHARACTERISTICS OF OPTICAL PROBES
N. Abuaf, O. C. Jones, Jr., and G. A. Zimmer 1978 12 p refs Presented at Am. Soc. of Mech. Engr. Meeting, San Francisco, 10 Dec. 1978
(Contract EY-76-C-02-0016)
(BNL-NUREG-24479; CONF-781202-17) Avail: NTIS HC A02/MF A01

An optical probe capable of measuring local void fraction and interface velocities in water-air or water-steam environments was developed, constructed, and calibrated in an air-water loop. The probe was found to be sensitive to both the interface velocity and the phase present at the probe tip. The dependence of the output on the bubble velocity was related to a thin water film left on the probe tip during the passage of the bubble, whose thickness was increasing with the bubble velocity. The various probe tip geometry response characteristics were evaluated using a computer program. DOE

N80-15386# National Ocean Survey, Rockville, Md. Test and Evaluation Lab.
PERFORMANCE EVALUATIONS OF THE ORBISPHERE LABORATORIES MODELS 2702 AND 2709 OXYGEN MEASURING SYSTEMS
Jerald M. Peterson, Charles C. White, Barbara S. Pijanowski, and Gary K. Ward Jun. 1979 20 p
(PB-300721/8; NOAA-TM-NOS-22; NOAA-79071203) Avail: NTIS HC A02/MF A01 CSCL 14B

Test and evaluation results are reported for two portable systems designed to measure temperature and dissolved oxygen concentrations. System descriptions, manufacturer's specifications, and performance results are provided with associated figures and tables summarizing accuracy, precision, stability, and environmental effects. GRA

N80-15387# National Bureau of Standards, Boulder, Colo. Building Thermal and Service Systems Div.
EVALUATION OF HAND-HELD INFRARED THERMOMETERS FOR WALL THERMAL RESISTANCE DETERMINATIONS
Stephen J. Treado and Douglas M. Burch Jul. 1979 27 p refs Sponsored in part by DOE
(PB-298057/1; NBSIR-79-1736) Avail: NTIS HC A03/MF A01 CSCL 10A

Hand-held infrared (IR) noncontact surface thermometers from two manufacturers were tested to evaluate their effectiveness in measuring surface temperatures for the determination of the thermal resistance of walls. Two phases of the test were performed, first a laboratory test of a wood-frame wall, followed by a field test of a brick veneer wood-frame wall. During both phases of testing, additional measurements of thermal resistance were made for comparative purposes, using multi-junction thermopiles and heat flow meters. An error analysis of the thermal resistance measurement procedure using IR surface thermometers was also performed. GRA

N80-15388# Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group.
DATA ACQUISITION AND REDUCTION FOR A HIGH-RESOLUTION FIELD IONISATION MASS SPECTROMETER
T. G. Tonkin May 1979 66 p
(PB-299936/5; CSIR-CENG-281; ISBN-0-7988-1602-3) Avail: NTIS HC A04/MF A01 CSCL 07D

Data from a mass spectrometer, under the control of a DGC NOVA3 minicomputer, are converted into an integrated molecular mass spectrum using programs written in the multi-task version of DGC Extended BASIC. The mathematical processing of the raw spectrum is done by means of deconvolution technique. The spectrum is presented in a table of molecular mass and quantity. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-15389# Columbia Univ., New York.
OPTICALLY PUMPED LASER ACTION AND ENERGY TRANSFER IN POLYATOMIC MOLECULES Final Report, 1 May 1975 - 30 Apr. 1977
George W. Flynn 20 Jun. 1978 14 p refs
(Contract N00014-75-C-1106)
(AD-A074985; TR-1) Avail: NTIS HC A02/MF A01 CSCL 20/5

Energy transfer and chemical decomposition processes have been studied in a number of molecules using laser fluorescence and time resolved thermal lensing techniques. Vibrational relaxation of OCS, and vibrational energy exchange between isotopic species of CH3F, and the laser driven, CH3F sensitized

decomposition of tetramethyl dioxetane have all been investigated. GRA

N80-15390# Army Electronics Research and Development Command, Fort Monmouth, N. J. Night Vision and Electro-optics Labs.
ADVANCED EXCITATION TECHNIQUES FOR TUNABLE INFRARED LASERS
T. F. Ewanizky Jul. 1979 16 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A074632; DELNV-TR-79-2) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report describes the theoretical concept and experimental progress initiated to devise a tunable laser source, broadly tunable over the middle infrared wavelength range. The concept derives from frequency conversion by scattering from coherently driven Raman vibrations in hydrogen or methane gas. This investigation concentrated on the feasibility of producing a wide-band tunable, infrared source using a designator energy category Nd:YAG pump laser to simultaneously drive a lithium niobate parametric oscillator and coherent Raman mixing in gaseous media. GRA

N80-15391# Atomic Weapons Research Establishment, Aldermaston (England).
THE CONSTRUCTION AND PERFORMANCE OF TEAL
P. L. Eggins, R. J. Prosser, and A. C. Simmons Jun. 1979 36 p refs
(AD-A074746; AWRE-O-9/79; DRIC-BR69056) Avail: NTIS HC A03/MF A01 CSCL 20/5

The construction of TEAL (Transversely Excited Atmospheric pressure Laser) is described with reference to the required specification for single pulse thermal blooming experiments. All the major performance parameters are described, such as energy, temporal profile, spectrum and stability. In particular, several different measurements of the spatial profile are compared with theoretical predictions, which in general predict well the main features but not the finer details. Also the results of pulse stretching experiments are described, in which the pulse is lengthened from 3 to 14 microsec. GRA

N80-15392# Naval Postgraduate School, Monterey, Calif.
A SIMPLE MODEL FOR CALCULATING THE INDEX OF REFRACTION OF NEON I AND NEON (3S) IN THE CAVITY OF A XENON FLUORIDE LASER M.S. Thesis
James Etchechury Jun. 1979 54 p refs
(Contract N00014-79-WR-90174; ARPA Order 3747)
(AD-A074380; NPS69-79-005) Avail: NTIS HC A04/MF A01 CSCL 20/5

A model for calculating the index of refraction of atomic species present in the cavity of a Xenon Fluoride Laser is applied to Neon and Neon*(3s). The model considers the variation from unity to be a function of the absorption cross section. Below the ionization threshold, the cross section is a set of discrete transitions between the various energy levels of the species of concern. Above the 5p level, the discrete transitions become indistinct and the continuum cross section function is extended into this region. The continuum cross section function is a polynomial function fitted to independent research results. The results for Neon I agree with previous theoretical and experimental results. The model is extended to Neon*(3s). Comparison with the results of independent research of the polarizability and cavity phase shift derived from the calculation indicate accuracy is within ten percent. GRA

N80-15393# Missouri Univ. -St. Louis. Dept. of Physics.
POTENTIAL LASER ACTION IN THE He-METAL VAPOR MIXTURES Final Report
Jacob J. Leventhal 24 Sep. 1979 3 p refs
(Contract N00014-76-C-0760)
(AD-A074594; Rept-3) Avail: NTIS HC A02/MF A01 CSCL 20/5

Energy transfer in atomic and molecular interactions is experimentally studied by analyzing photons from radiative decay of excited species formed in the collision process. Emphasis is on production of excited states that radiate in the soft x-ray and optical regions of the spectrum. Selective excitation in such processes can lead to the inverted state distributions necessary for the laser or superradiant operation. GRA

N80-15394# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF PLASMA PROCESSES IN ELECTRONIC TRANSITION LASERS Technical Report, 1 Jul. 1978 - 1 Jul. 1979
William L. Nighan 1 Sep. 1979 38 p refs
(Contract N00014-76-C-0847)
(AD-A074892; UTRC/R79-922617-4) Avail: NTIS HC A03/MF A01 CSCL 20/5

This paper reports the results of an analysis of basic kinetic and plasma processes in fast-pulse (about 100 nsec) electric discharges containing mixtures of the mercuric-bromide molecule HgBr2, ahp N2 in a Ne background. Formation of the laser molecule HgBr (B 2 Sigma(-)) is shown to occur as a result of dissociative excitation transfer following quenching of N2 (A 3 Sigma(-) sub u) by HgBr2. GRA

N80-15395# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
LASER INTRACAVITY MODULATION AND STABILIZATION
Richard A. Curtis May 1979 25 p refs
(AD-A074879; DRDMI-T-79-69) Avail: NTIS HC A02/MF A01 CSCL 20/5

The description of a method of generating optical-frequency sensitivity signals in single mode lasers is presented in this report. The technique involves controlled coupling of energy from the optical mode having gain to other laser cavity resonances using an intracavity phase modulator. The theory which applies to this work was obtained from the coupled mode equations of Harris and McDuff and is based on single mode laser stabilization theory of McDuff and Curtis. Experiments were performed which verified the theory using a single mode, carbon dioxide laser and a cadmium telluride (CdTe) electro-optic modulator. A closed loop system was constructed which was similar to that used by Targ, Osterink and French with a multimode, HELIUM-NEON laser. GRA

N80-15396# Naval Postgraduate School, Monterey, Calif.
STIMULATED EMISSION BY RELATIVISTIC ELECTRONS TRAVERSING A PERIODIC MAGNETIC FIELD M.S. Thesis
Robert Boyce Ellis Jun. 1979 72 p refs
(AD-A073888) Avail: NTIS HC A04/MF A01 CSCL 20/5

A historical survey of scientific developments predating the free electron laser (FEL) concept is presented. A general theory of operation of the FEL is discussed. The use of electromagnets to generate a static periodic magnetic field of alternating polarity (as a pump wave source) is proposed. Preliminary measurements with respect to the proposed electromagnet design are analyzed. GRA

N80-15397# Naval Research Lab., Washington, D. C.
ANALYTIC ANALYSIS OF LINEAR GROWTH RATES OF GYROTRON FOR TEIns MODE WITH ZERO-TEMPERATURE BEAM ELECTRONS
Joon Y. Choe (Maryland Univ.) and Saeyoung Ahn 29 Jun. 1979 57 p ref
(AD-A074368; AD-E000324; NRL-MR-4035) Avail: NTIS HC A04/MF A01 CSCL 20/5

The approximate expression for the growth rate of the transverse electric (TE) mode with the azimuthal mode number 'l', the radial mode number 'n', and the magnetic harmonic number 's' of the electron cyclotron maser instability with zero-temperatured beam electrons is derived and analytically examined. It has been found that there exist two branches of instabilities distinguished by their axial wavenumbers; the short and the long wavelength modes, and the estimates of their growth rates have been obtained. With maximization processes of the growth rates, the optimum conditions on various parameters have been found. In particular, it has been found that 's' equals 'l' mode with the beam center coinciding with the axis yields the highest growth rate. The exponential behavior of the growth with respect to the magnetic harmonic number 's' is also obtained. GRA

N80-15398# Visidyne, Inc., Burlington, Mass.
ROCKETBORNE LASER BACKSCATTER EXPERIMENT Final

Report, 6 May 1976 - 15 Feb. 1979
O. Shepherd, A. G. Hurd, W. H. Sheehan, and R. D. Bucknam Hanscom AFB, Mass. AFGL 15 Mar. 1979 164 p refs
(Contract F19628-76-C-0253; AF Proj. 6690)
(AD-A073853; VI-475; AFGL-TR-0081) Avail: NTIS HC A08/MF A01 CSCL 20/6

A previously flown rocket payload designed to measure atmospheric density in the thermosphere through Rayleigh backscatter of a dye laser signal, was modified and refurbished. In its earlier field test the payload failed to provide any data, apparently because of a timing problem. Relaunched, the laser failed to operate because of a minor component failure. However, measured background intensities were orders of magnitude higher than anticipated. The source of the background signals has not been positively identified since the rocket aspect data have not been finalized. The most likely source appears to be scattering from the Earth's atmosphere illuminated by the below horizon sun. GRA

N80-15399# Hughes Aircraft Co., Culver City, Calif. Electro-Optical and Data Systems Group.
HIGH ENERGY OPTICAL RESONANCE TRANSFER LASER STUDY. VOLUME 1: LABORATORY EXPERIMENTS Final Report, 24 Jul. 1978 - 23 Jun. 1979
P. Baily, J. Finzi, C. Lovejoy, and J. Wang Aug. 1979 82 p refs
(Contract N00173-78-C-0470; DARPA Order 2062)
(AD-A074126; HAC-FR-79-73-999-Vol-1; HAC-REF-E2380-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 20/5

This report describes characterization experiments investigating an HF intramolecular Optical Resonance Transfer Laser (ORTL), with variation in pump laser characteristics, ORTL volume and ORTL medium composition, pressure, and flow velocity. Input coupling, conversion, and overall efficiency were characterized in several different geometries. Maximum values of 83 per cent for conversion efficiency and 29 per cent for overall efficiency were observed. Initial temporal measurements revealed no dynamic feedback interaction in the intra-cavity configuration. Diffraction limited ORTL beam quality was observed. GRA

N80-15400# Los Alamos Scientific Lab., N. Mex.
INVESTIGATION OF EFFICIENCY OPTIMIZATION IN FREE ELECTRON LASERS
T. J. Kwan 1979 25 p refs Presented at ONR Workshop on Electron Generators of Coherent Radiation, Telluride, Colo., 13-17 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2176; CONF-790853-2) Avail: NTIS HC A02/MF A01

The dynamics of trapped particles in the presence of the wiggler magnetic field and the electromagnetic radiation field in free electron lasers were investigated. From the results of computer simulations, it was found that, for a given set of parameters, the efficiency of energy extraction from the electron beam maximizes at a particular intensity of the electromagnetic radiation. Based on the physical argument of the dynamics of the trapped particles, a criterion which predicts accurately the optimum intensity of the electromagnetic radiation was obtained. DOE

N80-15401# California Univ., Livermore. Lawrence Livermore Lab.
MICRO-FRESNEL STRUCTURES FOR MICROSCOPY OF LASER GENERATED BRIGHT X-RAY SOURCES
N. M. Ceglio, D. C. Shavers (Lincoln Lab., MIT, Lexington), D. C. Flanders (Lincoln Lab., MIT, Lexington), and H. I. Smith (Lincoln Lab., MIT, Lexington) 5 Jun. 1979 30 p Presented at Conf. on Ultrasoft X-ray Microscopy, New York, 13 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82684; CONF-790674-1) Avail: NTIS HC A03/MF A01

A brief parametric survey of the X-ray characteristics of a gold micro-disk irradiated at 3 x 10 to the 14th power watt/sq cm by a 1 nsec Nd-glass laser pulse was provided as an example of a laser generated bright X-ray source. It was shown that a simple phenomenological model of the laser generated X-ray source as a microscopic equilibrium plasma radiating as a blackbody for a finite time determined by its hydrodynamic disassembly and radiation losses, serves to provide an adequate approximation to the X-ray characteristics of such sources. The current state of X-ray microscopy within the LLL laser fusion program was briefly reviewed. DOE

N80-15402# Los Alamos Scientific Lab., N. Mex.
TUNABLE LASERS FOR WASTE MANAGEMENT PHOTOCHEMISTRY APPLICATIONS
F. T. Finch, comp. Sep. 1978 59 p refs
(Contracts W-7405-eng-36; EY-76-C-02-0016)
(LA-7113-MS) Avail: NTIS HC A04/MF A01

The recent literature on dye-laser characteristics was reviewed and summarized, with emphasis on those parameters that most likely affect the scaling of dye lasers in photochemical applications. Current costs are reviewed and correlated with output power. A new class of efficient uv lasers that appear to be scalable in both energy output and pulse rate, based on rare-gas halide excimers and similar molecules, is certain to find major applications in photochemistry. Because the most important developments are too recent to be adequately described in the literature or are the likely outcome of current experiments, the basic physics underlying the class of excimer lasers is described. The technical characteristics of the various classes of lasers in the ir are summarized. DOE

N80-15403# Brookhaven National Lab., Upton, N. Y.
PRINCIPLES, CALIBRATION AND PROCESS EXPERIENCE FOR A NEW LASER AEROSOL DETECTOR SYSTEM
F. M. Shofner, W. E. Harrison, Jr., and A. C. Miller, Jr. 1978 24 p refs Presented at the 71st Meeting of the AIChE, Miami, Fla., 12 Nov. 1978 Prepared in cooperation with Process Particulate Monitors, Inc., Knoxville, Tenn.
(Contract EY-76-C-02-0016)
(BNL-25018; CONF-781110-4) Avail: NTIS HC A02/MF A01

A laser particulate detection instrument which has proved extremely valuable in the design and monitoring of oil removal systems for cryogenic refrigeration systems is described. When located at the inlet of a refrigerator, any aerosol or particulates that could be harmful to the operation of the refrigerator would be detected. Its main features include: in situ measurement of particulates in the high pressure helium, continuous monitoring with alarm capabilities which permits automatic shutdown of attended or unattended systems, sensitivity down to a few parts per billion, long term stability on the order of 10 ppB, and straightforward data interpretation. The concept of continuous automatic calibration and baseline zero adjustment relieves the operator of any manual adjustments or loss of confidence in the signal levels recorded. The 1-second response time allows instant turnoff if the filters experience an oil breakthrough or if an operator inadvertently opens bypass valves around the oil removal system. DOE

N80-15404# Oak Ridge National Lab., Tenn. Analytical Chemistry Div.
PULSED DYE LASER OAS WITH A HELMHOLTZ RESONATOR CELL
R. W. Shaw 1979 10 p refs Presented at Meeting on Photoacoustic Spectry, Ames, Iowa, 1 Aug. 1979
(Contract W-7405-eng-26)
(CONF-790819) Avail: NTIS HC A02/MF A01

A Helmholtz resonator cell for simplifying pulsed dye laser excited optoacoustic signals is described and employed for high resolution optoacoustic spectroscopy of holmium oxide powder. DOE

N80-15405# Los Alamos Scientific Lab., N. Mex.
MIRROR QUALITY REQUIRED BY THE ANTARES LASER SYSTEM
W. C. Sweatt 1979 8 p refs Presented at the Conf. on Optics, Los Alamos, N. Mex., 23 May 1979
(Contract W-7405-eng-36)
(LA-UR-79-2058; CONF-790529-8) Avail: NTIS HC A02/MF A01

The mirror surface specifications are refined to a physically meaningful set based on the performance of the system. The optical specification for Antares is that 80 percent of the energy from each beam should be deliverable inside a 400 micron cycle.

The diffraction limited focal spot is 160 microns across, so small amounts of low spatial frequency wavefront aberrations are acceptable. The figure error is specified separately from the higher spatial frequency subfigure errors that diffract light out of the 400 micron circle. DOE

N80-15406# Avco-Everett Research Lab., Mass.
TRIPLING OF CO2 LASER RADIATION IN DBr, DCl AND Se Final Report, 1 May 1977 - 31 Jan. 1979
M. J. Yoder Mar. 1979 129 p refs
(Contract ES-77-C-02-4253)
(COO-4253-7) Avail: NTIS HC A07/MF A01

Frequency tripling of CO2 lasers in deuterium chloride (DCl), deuterium bromide (DBr), and selenium (Se) gases is discussed. Theoretical tripling equations are reviewed and summarized. Third order nonlinear susceptibilities, chi (3), for DCl, DBr, and Se are calculated. Experimental measurements of frequency tripling in high pressure DCl and DBr are discussed. Resonantly enhanced four-wave sum-frequency generation in Se using simultaneous 9.5 and 10.6 micrometer CO2 laser pulses is demonstrated. The necessary selenium vapor density is generated in a shock tube. All of the experiments are in relatively good agreement with theory and results in chi (3) values of 1.4 x 10 to the minus 37th power ESU for DBr, 2.0 x 10 to the minus 36th power for DCl, and 1.1 x 10 to the minus 33rd power for Se at 2000 K. Scaling equations are discussed which predict frequency conversion efficiencies of > 50 percent in DCl and Se using gigawatt power, nanosecond pulsed CO2 lasers and reasonably sized conversion cells. DOE

N80-15407# California Univ., Livermore. Lawrence Livermore Lab.
COMPACT 5 x 10-12 AMP/SEC RAIL-GUN PULSER FOR A LASER PLASMA SHUTTER
L. P. Bradley, E. L. Orham, and I. F. Stowers 12 Jun. 1979 15 p refs Presented at the 2nd IEEE Intern. Pulsed Power Conf., Lubbock, Tex., 12-14 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82539; CONF-790622-21) Avail: NTIS HC A02/MF A01

A rail-gun plasma source that produces a plasma of (10 to the 12th power)/cu cm particle density and projects it with a velocity of 3.9 cm/microsec was developed. The device will be used in an output spatial filter to project a critical density plasma across an optical beam path and block laser retroreflected light. The design of pulser appropriate to the laser fusion facility and the preliminary design of a higher current prototype pulser for the laser fusion research facility are described. DOE

N80-15408# California Univ., Livermore. Lawrence Livermore Lab.
APPLYING A COMPENSATED PULSED ALTERNATOR TO A FLASHLAMP LOAD FOR NOVA
B. M. Carder and B. T. Merritt 12 Jun. 1979 16 p refs Presented at the Pulsed Power Conf., Lubbock, Tex., 2 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82473; CONF-790622-23) Avail: NTIS HC A02/MF A01

The compensated pulsed alternator (CPA), a large rotating machine that will convert mechanical, rationally stored energy into a single electrical impulse of very high power, is discussed. It is being optimized for driving flashlamps in a very large NOVA Nd:glass laser system. A circuit that will provide start-up current and assist in triggering the flashlamps is described and tested with a 200 kilojoule capacitor bank. Formulae that will assist in matching the flashlamp load to any given size CPA machine are also presented. DOE

N80-15409# National Technical Information Service, Springfield, Va.
ATMOSPHERIC EFFECTS ON LASER BEAMS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Sep. 1979
Brian Carrigan Sep. 1979 254 p Supersedes NTIS/PS-78/0992; NTIS/PS-77/0831; NTIS/PS-76/0843; NTIS/PS-75/670
(NTIS/PS-79/0981/5; NTIS/PS-78/0992; NTIS/PS-77/0831; NTIS/PS-76/0843; NTIS/PS-75/670) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

The compilation cites recent research on laser beam transmission through the atmosphere. Studies on molecular attenuation, turbulence, thermal blooming, atmospheric window flows, atmospheric composition, aerosols, infrared lasers, computerized simulation, and water vapor are included. The effects of attenuation on optical radar, optical communications, and infrared detection, are covered. This updated bibliography contains 246 abstracts, 36 of which are new entries to the previous edition. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-15410*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF PREDICTED AND EXPERIMENTAL PERFORMANCE OF LARGE-BORE ROLLER BEARING OPERATING TO 3.0 MILLION DN
Harold H. Coe and Frederick T. Huller Jan. 1980 20 p refs
(NASA-TP-1599; E-063) Avail: NTIS HC A02/MF A01 CSCL 13I

Bearing inner and outer race temperatures and the amount of heat transferred to the lubricant were calculated by using the computer program CYBEAN. The results obtained were compared with previously reported experimental data for a 118 mm bore roller bearing that operated at shaft speeds to 25,500 rpm, radial loads to 8,900 N (2000 lb), and total lubricant flow rates to 0.0102 cu m/min (2.7 gal/min). The calculated results compared well with the experimental data. Author

N80-15411*# Detroit Diesel Allison, Indianapolis, Ind.
PLASMA-SPRAYED DUAL DENSITY CERAMIC TURBINE SEAL SYSTEM Final Report
D. L. Clingman, B. Schechter, K. R. Cross, and J. R. Cavanagh Oct. 1979 67 p refs
(Contract NAS3-21263)
(NASA-CR-159739; EDR-10085) Avail: NTIS HC A04/MF A01 CSCL 11A

Dual density, plasma sprayed ceramic coating systems were investigated for possible application as abradable turbine tip seal systems in small gas turbine engines. Abradability, erosion resistance, internal leakage, and microstructural characterization were investigated for polyester and cenosphere filled zirconium oxide composites. Results indicate the polyester system is more abradable but displays significantly less erosion resistance than the cenosphere system. It is also stated that the absence of significant blade tip damage during abradability testing of both systems suggests additional effort may result in a more nearly optimum balance of abradability and erosion resistance. M.G.

N80-15412*# Battelle Columbus Labs., Ohio.
EVALUATION OF WORN SSME LOW PRESSURE LIQUID OXYGEN TURBOPUMP BEARING Final Report
K. F. Dufrane and J. W. Kannel 14 Dec. 1978 29 p refs
(Contract NAS8-33576)
(NASA-CR-161367) Avail: NTIS HC A03/MF A01 CSCL 13I

The larger of two ball bearings used to support the rotor of the low pressure liquid oxygen turbopump in each of the shuttle main engines was analyzed to identify the cause of severe internal wear. The actual operating loads were calculated along with their direction and length of time at each load based on the size and location of the race contact paths. It is suggested that the engine component design be modified to reduce bearing stress and enhance lubrication. K.L.

N80-15413# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EVALUATION OF 100 mm BORE BEARINGS AFTER ACCELERATED TESTING IN A SIMULATED SPACE ENVIRONMENT Interim Report, Oct. 1976 - Sep. 1977
Wayne E. Ward Jul. 1979 50 p refs

(AF Proj. 2421)
(AD-A074527; AFML-TR-79-4083) Avail: NTIS HC A03/MF A01 CSCL 22/2

The Despin Mechanical Assembly (DMA) is that mechanism by which satellite antenna platforms are despun with respect to the remainder of the vehicle in order to permit data transfer as well as navigational command and control. A major component of this assembly is a set of DMA bearings. Because of the extended duration of most satellite missions, the DMA itself as well as the individual components undergo rigorous life and accelerated life testing. On occasion, a test article fails to meet the desired or anticipated performance level. This report describes the analysis of a set of specially fabricated DMA type bearings which experienced such a failure during an accelerated life test. Physical, chemical, and pictorial evidence is presented to support the postulated cause of failure. GRA

N80-15414# Illinois Univ. at Urbana-Champaign. Dept. of Mechanical and Industrial Engineering.
PRELIMINARY STUDY OF A RECOIL MECHANISM USING COULOMB FRICTION Final Report
C. Cusano and H. J. Sommer, III Jul. 1979 78 p refs
(Contract DAAK10-78-C-0152)
(AD-A074203) Avail: NTIS HC A05/MF A01 CSCL 19/6

This report is an investigation of the possible use of Coulomb friction for recoil energy dissipation in a friction recoil mechanism (FRM) for large bore cannon. Basic concepts and experimental friction material characteristics contributing to FRM functional and logistic feasibility are presented. From practical considerations, a recoil mechanism should be a relatively passive system incorporating automatic or intrinsic actuation prior to or at firing, should be self-contained, and should be tolerant of or compensate for variations in recoil travel. From a logistics standpoint, a recoil mechanism should demonstrate an extended in-service life, allow simple field servicing and repair, and permit long-term storage with rapid field recommission. The ultimate consideration of such a recoil system is its reliability over repeated firings. A single failure may cause catastrophic equipment damage and/or personnel injury. The comparative simplicity of conceptualized FRM hardware should allow superior performance in all three logistic areas stated above. FRM live/service interval would be a calculable function of the friction material wear rate and not a statistical estimate of effective seal life before failure. The simplicity and mechanical nature of FRM design should permit less complex service procedures. GRA

N80-15415# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
ANALYTICAL MODELS AND EXPERIMENTAL STUDIES OF CENTRIFUGAL-PUMP PERFORMANCES IN TWO-PHASE FLOW Final Report
D. G. Wilson, T. Chan, and J. Manzano-Ruiz May 1979 221 p refs
(EPRI Proj. 493)
(EPRI-NP-677) Avail: NTIS HC A10/MF A01

Two phase flow data and models for centrifugal pumps are reviewed. A method is then developed for predicting two phase pump performance for steady state and transient conditions, assuming that pump geometry and normal single phase pump characteristics are known. The method is used to accurately predict the first-quadrant two phase performance of a pump. K.L.

N80-15416# Sandia Labs., Albuquerque, N. Mex.
STRUCTURAL MODELING OF A THICK-RIM ROTOR
A. K. Miller 1978 8 p refs Presented at 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1941C; CONF-781046-7) Avail: NTIS HC A02/MF A01

A NASTRAN structural model is constructed of a thick-rim rotor having six discrete overwrapped bands forming twelve pairs of spokes--the wagon-wheel rotor. The results of an experimental modal analysis of an actual rotor, using Fast Fourier transform techniques, are used to aid in the definition and refinement of the numerical model. A description of the structural model is given and the resulting calculated normal mode shapes and frequencies are presented. These mode shapes and frequencies are compared to those obtained from the experimental modal analysis. DOE

N80-15417# Westinghouse Electric Corp., Lester, Pa. Steam Turbine Div.
TURBINE CYCLE PERFORMANCE IMPROVEMENT THROUGH TITANIUM LP BLADES Interim Report
W. G. Steltz Sep. 1978 34 p refs Sponsored by EPRI
(EPRI-AF-903) Avail: NTIS HC A03/MF A01

A coordinated study comprising thermodynamic, mechanical, and economic analyses was made of the application of long titanium low pressure steam turbine blades in power generating units. Turbine cycle heat rate improvements of 1% for fossil units and 2% for nuclear units are indicated for machines utilizing increased last row blade lengths of 30 to 40%. DOE

N80-15418# National Technical Information Service, Springfield, Va.
LASER WELDING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Aug. 1979
William E. Reed Oct. 1979 285 p Supersedes NTIS/PS-78/0984; NTIS/PS-77/0816
(NTIS/PS-79/1028/4; NTIS/PS-78/0984; NTIS/PS-77/0816) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Reports from worldwide research are cited which deal with the development of techniques and procedures for laser welding and with the characteristics of the resulting welds. Process control, automation, and applications are also investigated. Materials welded include stainless steels, dissimilar metals, titanium, ceramics, and plastics. This updated bibliography contains 278 abstracts, 29 of which are new entries to the previous edition. GRA

N80-15419# Connecticut Univ., Storrs. Dept. of Civil Engineering.
EXPERIMENTAL EVALUATION OF A PORTABLE ENERGY ABSORBING SYSTEM FOR HIGHWAY SERVICE VEHICLES Final Report, Jun. 1977 - Dec. 1978
John F. Carney, III Apr. 1979 61 p refs
(PB-299168/5; CE-79-125; FHWA/CT/RD-402-F-79-1) Avail: NTIS HC A04/MF A01 CSCL 13F

A portable energy absorbing system which is attached to the rear of a standard 14,000 pound highway service vehicle used in maintenance operations was designed and fabricated. A full scale crash testing program was conducted to evaluate the structural integrity and performance of the portable energy absorbing system. The results demonstrate that this energy absorbing system provides protection during a collision for both the errant motorist and the state personnel working in the service vehicle. GRA

N80-15420# Environmental Protection Agency, Ann Arbor, Mich. Inspection and Maintenance Staff.
EFFECTS OF INSPECTION AND MAINTENANCE PROGRAMS ON FUEL ECONOMY
Mar. 1979 15 p refs
(PB-297583/7; IMS-001/FE/1) Avail: NTIS HC A02/MF A01 CSCL 13B

The primary goal of inspection and maintenance (I/M) programs is to improve air quality by reducing emissions from motor vehicles. Many studies indicate that I/M programs will achieve this goal. In addition several studies indicate that fuel economy improvement can be expected to occur as a result of maintenance performed on vehicles failing an I/M test. Most studies looked at pre-1975 model year vehicles and had expert mechanics performing the maintenance work. Both the results from past studies and the results from more recent studies are considered to provide EPA's best estimates of fuel economy benefit which can be attributed to I/M maintenance. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-15421# Aeronautical Research Labs., Melbourne (Australia).
THE APPLICATION OF IMAGE PROCESSING TO THE

DETECTION OF CORROSION BY RADIOGRAPHY
M. E. Packer Feb. 1979 29 p
(ARL/MAT-Rept-109; AR-001-598) Avail: NTIS HC A03/MF A01

The improvement of radiographic corrosion detection through computer processing of digitized radiographs was investigated. Linearization of the image-density distribution was used to enhance the contrast of details associated with corrosion, but no conclusive evidence was obtained that image processing results in the detection of corrosion not already apparent on an unprocessed radiograph. A potential method for analyzing the history of a corrosion site was discovered. K.L.

N80-15422*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHOTOVOLTAIC POWER SYSTEM RELIABILITY CONSIDERATIONS
Vincent R. Lalli 1980 9 p refs Presented at the Ann. Reliability and Maintainability Symp., San Francisco, 22-24 Jan. 1980
(Contract DE-AB29-76EI-20370)
(NASA-TM-79291; DOE/NASA/20370-79/19; E-235) Avail: NTIS HC A02/MF A01 CSCL 14D

An example of how modern engineering and safety techniques can be used to assure the reliable and safe operation of photovoltaic power systems is presented. This particular application is for a solar cell power system demonstration project designed to provide electric power requirements for remote villages. The techniques utilized involve a definition of the power system natural and operating environment, use of design criteria and analysis techniques, an awareness of potential problems via the inherent reliability and FMEA methods, and use of fail-safe and planned spare parts engineering philosophy. J.M.S.

N80-15423*# Raytheon Co., Sudbury, Mass.
CARE 3, PHASE 1, VOLUME 1 Final Report
J. J. Stiffler, L. A. Bryant, and L. Guccione Nov. 1979 111 p refs Sponsored in part by AFAL, Wright-Patterson, AFB, Ohio 2 Vol.
(Contract NAS1-15072)
(NASA-CR-159122) Avail: NTIS HC A06/MF A01 CSCL 14D

A computer program to aid in accessing the reliability of fault tolerant avionics systems was developed. A simple mathematical expression was used to evaluate the reliability of any redundant configuration over any interval during which the failure rates and coverage parameters remained unaffected by configuration changes. Provision was made for convolving such expressions in order to evaluate the reliability of a dual mode system. A coverage model was also developed to determine the various relevant coverage coefficients as a function of the available hardware and software fault detector characteristics, and subsequent isolation and recovery delay statistics. R.C.T.

N80-15424*# Raytheon Co., Sudbury, Mass.
CARE 3, PHASE 1, VOLUME 2 Final Report
J. J. Stiffler, L. A. Bryant, and L. Guccione Nov. 1979 220 p refs Sponsored in part by AFAL, Wright-Patterson AFB, Ohio 2 Vol.
(Contract NAS1-15072)
(NASA-CR-159123) Avail: NTIS HC A10/MF A01 CSCL 14D

A computer program was developed as a general purpose reliability tool for fault tolerant avionics systems. The computer program requirements, together with several appendices containing computer printouts are presented. R.C.T.

N80-15425# Oak Ridge National Lab., Tenn.
METALLOGRAPHIC QUALITY CONTROL OF WELDING AND BRAZING
G. M. Slaughter 1979 22 p refs Presented at Intern. Metallographic Soc. Conf., Taniment, Pa., 8 Jul. 1979
(Contract W-7405-eng-26)
(CONF-790730-1) Avail: NTIS HC A02/MF A01

The value of metallography in assuring integrity in the fabrication of metal and components in energy systems is summarized. The role of metallography in the quality control of welded and brazed joints is discussed. DOE

N80-15426# Los Alamos Scientific Lab., N. Mex.
EXTENDED LIKELIHOOD INFERENCE IN RELIABILITY
H. F. Martz, Jr., R. J. Beckman, and R. A. Waller Oct. 1978 34 p refs
(Contract W-7405-eng-36)
(LA-7517-MS) Avail: NTIS HC A03/MF A01

Several extended likelihood methods of inference are developed in which subjective information in the form of a prior distribution is combined with sampling results by means of an extended likelihood function. The extended likelihood function is standardized for use in obtaining extended likelihood intervals. The extended likelihood intervals are derived for the mean of a normal distribution with known variance, the failure rate of an exponential distribution, and the parameter of a binomial distribution. The extended second-order likelihood methods are developed and used to solve several prediction problems associated with the exponential and binomial distributions. In particular, such quantities as the next failure time, the number of failures in a given time period, and the time required to observe a given number of failures are predicted for the exponential model with a gamma prior distribution on the failure rate. In addition, six types of life testing experiments are considered. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-15427# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE EFFECT OF INITIAL TWIST ON THE TORSIONAL RIGIDITY OF BEAMS: ANOTHER POINT OF VIEW
Aviv Rosen Apr. 1978 28 p
(TAE-360) Avail: NTIS HC A03/MF A01

The known theory on the effect of initial twist on the torsional rigidity of beams is examined. A few weak points and inaccuracies of the theory are pointed out, and a completely different explanation of the phenomenon is presented. It is shown that in special cases where there was a very good agreement between theory and experiments, the new theory gives results which are identical to those obtained using the old theory. R.E.S.

N80-15428*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A RELATION BETWEEN SEMIEMPIRICAL FRACTURE ANALYSES AND R-CURVES
Thomas W. Orange Jan. 1980 45 p refs
(NASA-TP-1600; E-9963) Avail: NTIS HC A03/MF A01 CSCL 20K

The relations between several semiempirical fracture analyses (SEFA) and the R-curve concept of fracture mechanics are examined and the conditions for equivalence between a SEFA and an R-curve are derived. A hypothetical material is employed to study the relation analytically. Equivalent R-curves are developed for several real materials using data from the literature. For each SEFA there is an equivalent R-curve whose magnitude and shape are determined by the SEFA formulation and its empirical parameters. If the R-curve is indeed unique, then the various empirical parameters cannot be constant, and vice versa. However, for one SEFA the differences are small enough that they may be within the range of normal data scatter for real materials. Author

N80-15429# Aeronautical Research Labs., Melbourne (Australia). Aeronautical Research Labs.
THE FRACTURE OF A PARACHUTE HOOK: A CASE STUDY OF THE ROLE OF MATERIALS PARAMETERS IN RELIABILITY ANALYSIS
L. R. F. Rose and B. J. Wicks Jul. 1979 27 p refs

(AR-001-591; ARL-MAT-NOTE-125) Avail: NTIS HC A03/MF A01

A detailed analysis of the risk of failure for the particular case of a parachute hook is used to illustrate what information is required for that purpose, how much of it is readily available, and in what areas further research is needed. The analysis relies on the use of a full scale test to identify the mode of failure, and hence the relevant strength parameter. It is concluded that an important role of materials research is to provide an understanding of the factors which can affect mechanical properties, so that the characteristics of the relevant population of structures or components may be more precisely defined, and the variability in strength which can be expected in service may be estimated. Author

N80-15430*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

STRESS-INTENSITY FACTORS AND CRACK-OPENING DISPLACEMENTS FOR ROUND COMPACT SPECIMENS

J. C. Newman, Jr. Oct. 1979 30 p refs

(NASA-TM-80174) Avail: NTIS HC A03/MF A01 CSCL 20K

A two dimensional, boundary collocation stress analysis was used to analyze various round compact specimens. The influence of the round external boundary and of pin-loaded holes on stress intensity factors and crack opening displacements was determined as a function of crack-length-to-specimen-width ratios. A wide-range equation for the stress intensity factors was developed. Equations for crack-surface displacements and load-point displacements were also developed. In addition, stress intensity factors were calculated from compliance methods to demonstrate that load-displacement records must be made at the loading points and not along the crack line for crack-length-to-specimen-width ratios less than about 0.4. K.L.

N80-15431# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.

A THEORY OF THERMOVISCOPLASTICITY FOR UNIAXIAL MECHANICAL AND THERMAL LOADING

E. P. Cernocky and E. Krempl Jul. 1979 41 p refs

(Contract N00014-78-C-0231)

(AD-A074957; RPI-CS-79-3) Avail: NTIS HC A03/MF A01 CSCL 20/11

A previously proposed three dimensional isotropic theory of Thermoviscoplasticity based on total infinitesimal strain is specialized to a uniaxial state of stress. This uniaxial theory consists of a first order differential constitutive equation linear in the mechanical strain rate and the stress rate but nonlinear in the mechanical strain, the temperature, and the stress. This equation is coupled to a constitutive heat equation where the work in a homogeneous, adiabatic cycle which starts and ends at zero stress is completely converted into temperature change. In cyclic loading, the mechanical constitutive equation is augmented through a procedure which we call 'storage and updating'. The qualitative solution properties of this system of differential equations are investigated. Assuming adiabatic conditions, it is shown that near the stress-strain-temperature origin or under large instantaneous changes in the strain (stress) rate, the predicted material behavior is thermoelastic. The solutions for large time under monotonic loadings are given. A set of material constants is assumed; the equations are numerically integrated to simulate homogeneous monotonic loading and cycling and corresponding deformation-induced temperature changes. Other examples include thermal monotonic and cyclic loading under constraint (thermal fatigue cycling) and mechanical cycling with simultaneous rapid heating. GRA

N80-15432# Missouri Univ. -Rolla. Dept. of Engineering Mechanics.

RESPONSE OF NONLINEAR STRUCTURAL PANELS SUBJECTED TO HIGH INTENSITY NOISE Final Report, 18 Jun. - 20 Aug. 1979

Chuh Mei Aug. 1979 42 p refs

(Contract F49620-79-C-0169; AF Proj. 2307)

(AD-A074986; AFOSR-79-0987TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

A theoretical research program has been carried out over the past two summers to establish preliminary sonic fatigue design information for estimating the responses of aircraft panels subjected to high intensity broadband acoustic excitation. It was demonstrated that a better correlation between theory and experiment can be achieved when large deflection geometrical nonlinearity effect was considered in the analysis. Results were also presented in graphical form, and they can be used as guides for preliminary design of aircraft panels. GRA

N80-15433# Ohio State Univ. Research Foundation, Columbus.

ON THE MULTIPLE SCATTERING OF WAVES FROM OBSTACLES WITH SOLID-FLUID INTERFACES Progress Report, 1 Oct. 1978 - 31 Jul. 1979

Bo. Peterson, V. V. Varadan, and V. K. Varadan Jul. 1979 29 p refs

(Contract N00014-78-C-0559)

(AD-A074057; OSURF-761251/711) Avail: NTIS HC A03/MF A01 CSCL 20/11

The purpose of this article is to present a T-matrix formalism for elastic wave scattering by multilayered regions with solid-fluid interfaces. Here the layers are not necessarily consecutively enclosing and thus in some regions there may be several different scatterers. We are using the Green's dyadic in an integral representation although the T-matrix can be obtained without using any Green's dyadic. GRA

N80-15434# Naval Ship Research and Development Center, Bethesda, Md.

ANALYTICAL SOLUTIONS FOR OPEN NONSHALLOW SPHERICAL SHELL VIBRATIONS

Gau-Feng Lin Sep. 1979 81 p refs

(AD-A074269; DTNSRDC-79/075) Avail: NTIS HC A05/MF A01 CSCL 20/11

This report is concerned with axisymmetric as well as nonsymmetric vibrations of open nonshallow thin elastic spherical shells. Without employing the usual auxiliary variables for reduction of shell motion equations introduced by VanderNeut and Berry, independent analytical solutions for middle-surface displacements are obtained and explicitly expressed in terms of associated Legendre functions. In order to gain physical insights into the free-vibration characteristics of an open nonshallow shell, theoretical calculations together with asymptotic descriptions are made of natural frequencies and mode shapes of a hemispherical shell with a free edge. Five families of natural frequencies, i.e., low Rayleigh bending, mixed bending-membrane, torsional, bending and membrane frequencies, are found. The corresponding mode shapes exhibit distinctive displacement patterns. GRA

N80-15435# Southwest Research Inst., San Antonio, Tex.

CRACK TIP PLASTICITY ASSOCIATED WITH CORROSION ASSISTED FATIQUE Interim Report, Jun. 1978 - Jun. 1979

D. L. Davidson and J. Lankford 31 May 1979 36 p refs

(Contract N00014-75-C-1038)

(AD-A073835; SWRI-02-4268) Avail: NTIS HC A03/MF A01 CSCL 11/6

A newly developed technique for measuring in-plane crack tip displacements and strains has been applied to the ongoing study of the effect of a water vapor environment on fatigue crack propagation in low-carbon steel. This stereoimaging technique allows the determination of the in-plane displacements with both high resolution and accuracy at numerous points in the near crack tip region. From these displacements the in-plane elements of the strain tensor and the principal strains and shear strains may be calculated. The principal effect of a water vapor environment on crack tip plasticity is that it causes a decrease in strain magnitude which the material at the crack tip supports, corroborating previous results derived from the measurement of subgrain size distribution. Information on the effect of environment on crack opening loads and on the 'compressive displacements' at the tip of the unloaded crack are also given, as are some preliminary results on the interrelationships between loading frequency, environment and crack propagation rate. GRA

N80-15436# Argonne National Lab., Ill. Components Technology Div.

SCALE MODELING OF FINITE LENGTH FLUID ANNULAR GAPS FOR FLOW-INDUCED VIBRATION TESTING

T. M. Mulcahy and A. J. Miskevics Jun. 1979 30 p refs
(Contract W-31-109-eng-38)
(ANL-CT-79-40) Avail: NTIS HC A03/MF A01

Possible scale model distortions for structural vibration testing are discussed. Conditions for which fluid energy dissipation is expected to be larger in a reduced scale model than in the prototype are defined. This unconservative and sometimes undesirable distortion is confirmed by testing of a vibrating rod surrounded by a finite length fluid filled annulus. A theory for estimating the magnitude of the distortion is presented. DOE

N80-15437# California Univ., Livermore. Lawrence Livermore Lab.
HUGONIOT ELASTIC LIMITS AND COMPRESSION PARAMETERS FOR BRITTLE MATERIALS
W. H. Gust 20 Jul. 1979 11 p refs Presented at the Intern. AIRAPT Conf., La Creusot, France, 30 Jul. 1979
(Contract W-7405-eng-48)
(UCRL-83020; CONF-790709-12) Avail: NTIS HC A02/MF A01

The Hugoniot elastic limit and dynamic yield strength in compression are determined for brittle materials using a free surface approximation for the elastic and phase transitional waves. Sound velocity, deviatoric stress, and Hugoniot data are given for a number of polycrystalline ceramics. K.L.

N80-15438# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
INELASTIC ANALYSIS OF TRANSVERSE DEFLECTION OF PLATES BY THE BOUNDARY ELEMENT METHOD
Mahesh Morjaria and Subrata Mukherjee Jun. 1979 54 p refs
(Contract EY-76-S-02-2733)
(COO-2733-24) Avail: NTIS HC A04/MF A01

The complicated boundary value problem for an arbitrarily shaped plate is solved by using a novel combination of the boundary element method and finite element methodology. The number of unknowns, however, depends upon the boundary discretization and is therefore less than in a finite element model. A combined creep-plasticity constitutive theory with state variables is used to model material behavior. The computer code developed can solve problems for an arbitrarily shaped plate with clamped or simply supported boundary conditions and an arbitrary loading history. Some illustrative numerical results for clamped and simply supported rectangular and triangular plates, under various loading histories, are presented and discussed. DOE

N80-15439# Los Alamos Scientific Lab., N. Mex.
LINEAR AND NONLINEAR SYMMETRICALLY LOADED SHELLS OF REVOLUTION APPROXIMATED WITH THE FINITE ELEMENT METHOD
William A. Cook Oct. 1978 64 p refs
(Contract W-7405-eng-36)
(LA-7538-MS) Avail: NTIS HC A04/MF A01

Nuclear material shipping containers have shells of revolution as a basic structural component. Analytically modeling the response of these containers to severe accident impact conditions requires a nonlinear shell-of-revolution model that accounts for both geometric and material nonlinearities. Present models are limited to large displacements, small rotations, and nonlinear materials. A first approach to developing a finite element nonlinear shell of revolution model that accounts for these nonlinear geometric effects is discussed. The approach uses incremental loads and a linear shell model with equilibrium iterations. Sixteen linear models are developed, eight using the potential energy variational principle and eight using a mixed variational principle. Four of these are suitable for extension to nonlinear shell theory. A nonlinear shell theory is derived, and a computational technique used in its solution is presented. DOE

N80-15440# Oak Ridge National Lab., Tenn. Engineering Technology Div.
UNIFIED CREEP-PLASTICITY MODEL FOR STRUCTURAL METALS AT HIGH TEMPERATURE
D. N. Robinson Oct. 1978 61 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5969) Avail: NTIS HC A04/MF A01

A constitutive theory for use in high-temperature structural analysis of breeder reactor components is presented. It is unified in the sense that plastic and creep strains are considered to arise from similar physical mechanisms. The theory is presented in multiaxial terms along with a discussion of its underlying assumptions, its relationship to other theories and the experimental observations upon which it is based and is intended to model. The results of an extensive parameter sensitivity study are reported which provide understanding of the influence of the various model parameters on the critical features of predicted response. DOE

N80-15441# O'Donnell and Associates, Inc., Pittsburgh, Pa.
MORE EFFICIENT CREEP RATCHETING BOUNDS
J. S. Porowski and W. J. ODonnell Oct. 1978 45 p refs
(Contract W-7405-eng-26)
(ORNL/SUB-7322/1) Avail: NTIS HC A03/MF A01

The O'Donnell-Porowski upper bound solutions for creep ratcheting are extended to include material hardening effects and temperature dependent yield properties. Energy methods are introduced in order to obtain more efficient bounds for loading histograms involving a limited number of severe cycles in the plastic ratcheting regime, interspersed with cycling of lesser magnitude. DOE

N80-15442# Sandia Labs., Albuquerque, N. Mex.
HONDO II: A FINITE ELEMENT COMPUTER PROGRAM FOR THE LARGE DEFORMATION DYNAMIC RESPONSE OF AXISYMMETRIC SOLIDS
S. W. Key, Z. E. Beisinger, and R. Krieg Oct. 1978 98 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0422) Avail: NTIS HC A05/MF A01

A finite element method computer program designed to calculate the large deformation elastic and inelastic transient dynamic response of two dimensional solids is presented. To accommodate a wide variety of applications, finite strain calculations are incorporated. Spatially, the program employs a four node isoparametric quadrilateral element. In time, the program performs the integration using a central difference method time integrator. Since the time integration scheme is only conditionally stable with respect to step size, the program continuously monitors the step size and adjusts it to keep the calculation stable. The program contains five material subroutines covering elastic, viscoelastic, elastic-plastic, crushable foam, and soil behavior. Initial conditions on velocity but not displacement are allowed. Pressure loadings are allowed. Thermal loads are not implemented. The program functions entirely in core, and because no stiffness matrices are calculated and stored, rather large problems are easily accommodated. DOE

N80-15443# Massachusetts Univ., Amherst. Dept. of Civil Engineering.
MITIGATING EFFECTS IN THE PLASTIC FAILURE OF SHELLS SUBJECTED TO AXIALLY DEPENDENT DYNAMIC PRESSURE LOADINGS
G. Horvay and M. A. Veluswami Jul. 1979 89 p refs
(Contract EY-76-S-02-4122)
(COO-4122-27) Avail: NTIS HC A05/MF A01

Plastic buckling of shells is analyzed incorporating a hoop restoring force term into the membrane deflection equation. The effects of a nonuniform pressure pulse and nonuniform stiffness of the shell in the axial direction are investigated. K.L.

N80-15444# Oak Ridge Gaseous Diffusion Plant, Tenn.
MODIFYING THE GNATS MESH GENERATION CODE TO IMPROVE THE MODELING OF BRANCHED STRUCTURES
S. V. McGrath and L. I. Schlemper May 1979 23 p
(Contract W-7405-eng-26)
(K/CSD/TM-26) Avail: NTIS HC A02/MF A01

Modifications to a mesh generator program that permit geometrically accurate representations of branched structures are described. These modifications delete additional elements employed to approximate branched structures and merge the common boundaries of the deleted elements. DOE

42 GEOSCIENCES (GENERAL)

N80-15445*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

BAROCLINIC INSTABILITY WITH VARIABLE GRAVITY: A PERTURBATION ANALYSIS

Albert C. Giere (Univ. Space Res. Assoc.), William W. Fowliss, and Salvador Arias Jan. 1980 30 p refs

(NASA-TP-1586; M-293) Avail: NTIS HC A03/MF A01 CSCL 08G

Solutions for a quasigeostrophic baroclinic stability problem in which gravity is a function of height were obtained. Curvature and horizontal shear of the basic state flow were omitted and the vertical and horizontal temperature gradients of the basic state were taken as constant. The effect of a variable dielectric body force, analogous to gravity, on baroclinic instability for the design of a spherical, baroclinic model for Spacelab was determined. Such modeling could not be performed in a laboratory on the Earth's surface because the body force could not be made strong enough to dominate terrestrial gravity. A consequence of the body force variation and the preceding assumptions was that the potential vorticity gradient of the basic state vanished. The problem was solved using a perturbation method. The solution gives results which are qualitatively similar to Eady's results for constant gravity; a short wavelength cutoff and a wavelength of maximum growth rate were observed. The averaged values of the basic state indicate that both the wavelength range of the instability and the growth rate at maximum instability are increased. Results indicate that the presence of the variable body force will not significantly alter the dynamics of the Spacelab experiment. The solutions are also relevant to other geophysical fluid flows where gravity is constant but the static stability or Brunt-Vaisala frequency is a function of height. R.C.T.

N80-15446*# Lamont-Doherty Geological Inst., Palisades, N. Y.

SHAPE OF THE OCEAN SURFACE AND IMPLICATIONS FOR THE EARTH'S INTERIOR: GEOS-3 RESULTS

M. E. Chapman, M. Talwani, H. Kahle, and J. H. Bodine Wallops Flight Center, Wallops Island, Va. NASA Nov. 1979 189 p refs

(Contract NAS6-2519)

(NASA-CR-156859) Avail: NTIS HC A09/MF A01 CSCL 08G

A new set of 1 deg x 1 deg mean free air anomalies was used to construct a gravimetric geoid by Stokes' formula for the Indian Ocean. Utilizing such 1 deg x 1 deg geoid comparisons were made with GEOS-3 radar altimeter estimates of geoid height. Most commonly there were constant offsets and long wavelength discrepancies between the two data sets; there were many probable causes including radial orbit error, scale errors in the geoid, or bias errors in altitude determination. Across the Aleutian Trench the 1 deg x 1 deg gravimetric geoids did not measure the entire depth of the geoid anomaly due to averaging over 1 deg squares and subsequent aliasing of the data. After adjustment of GEOS-3 data to eliminate long wavelength discrepancies, agreement between the altimeter geoid and gravimetric geoid was between 1.7 and 2.7 meters in rms errors. For purposes of geological interpretation, techniques were developed to directly compute the geoid anomaly over models of density within the Earth. In observing the results from satellite altimetry it was possible to identify geoid anomalies over different geologic features in the ocean. Examples and significant results are reported. R.C.T.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-15447*# Ministero dell'Agricoltura e delle Foreste, Rome (Italy).

TOPOGRAPHICAL CHARACTERISTICS THROUGH THE STUDY OF THE THERMAL AND HYDROLOGICAL DISUNIFORMITY OF THE SOIL FROM THE MESOSCALE. AN APPPLICATION TO LOCAL FORECASTING OF AMBIENT TEMPERATURE FROM THE TELLUS PROJECT [IL TELERILEVAMENTO PER LO STUDIO A MESOSCA LA DELLE DISUNIFORMITA TERMICHE ED IDRICHE DEL SUOLO. APPLICAZIONE ALLA PREVISIONE LOCALE DEI TEMPORALI NELL'AMBITO DEL PROGETTO TELLUS]

E. Rosini and P. Caponigro, Principal Investigators 1977 6 p In ITALIAN ERTS

(E80-10020; NASA-CR-162392) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-15448*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

PROCEEDINGS OF TECHNICAL SESSIONS, VOLUMES 1 AND 2: THE LACIE SYMPOSIUM

Jul. 1979 1095 p refs Symp. held at Houston, Tex., 23-26 Oct. 1978 Sponsored by NASA, NOAA, and USDA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(E80-10030; NASA-TM-80811; JSC-16015-Vol-1; JSC-16015-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 02C

The technical design of the Large Area Crop Inventory Experiment is examined and data acquired over 3 global crop years is analyzed with respect to (1) sampling and aggregation; (2) growth size estimation; (3) classification and mensuration; (4) yield estimation; and (5) accuracy assessment. Seventy-nine papers delivered at conference sessions cover system implementation and operation; data processing systems; experiment results and accuracy; supporting research and technology; and the USDA application test system. For individual titles, see N80-15449 through N80-15525.

N80-15449*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SAMPLING, AGGREGATION, AND VARIANCE ESTIMATION FOR AREA, YIELD, AND PRODUCTION IN LACIE

C. R. Hallum, R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.), A. H. Feiveson, and A. G. Houston, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 3-18 refs ERTS (For primary document see N80-15448 06-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

An approximately 2% sampling error was achieved in LACIE by sampling only approximately 2% of the sampling frame. The sample design in the yardstick region for which historical data were available down to a substratum level to support missing data resulting from cloud cover provided the most accurate estimate possible. The implemented strategy provided data of sufficient quality and quantity to support required performance levels and also to satisfy the existing constraints. The allocation scheme appeared to provide the most efficient usage of the available data and gave segment coverage of major producing areas and thus improved the probability of an accurate estimate. Author

N80-15450*# Department of Agriculture, Columbia, Md.

ECONOMETRIC MODELS FOR PREDICTING CONFUSION CROP RATIOS

D. E. Umberger, M. H. Proctor, J. E. Clark (Oregon State Univ., Corvallis), L. M. Eisgruber (Oregon State Univ., Corvallis), and C. B. Braschler, Principal Investigators (Missouri Univ., Columbia) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 19-46 refs ERTS (For primary document see N80-15448 06-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

Results for both the United States and Canada show that econometric models can provide estimates of confusion crop ratios that are more accurate than historical ratios. Whether these models can support the LACIE 90/90 accuracy criterion is uncertain. In the United States, experimenting with additional model formulations could provide improved methods models in

some CRD's, particularly in winter wheat. Improved models may also be possible for the Canadian CD's. The more aggressive province/state models outperformed individual CD/CRD models. This result was expected partly because acreage statistics are based on sampling procedures, and the sampling precision declines from the province/state to the CD/CRD level. Declining sampling precision and the need to substitute province/state data for the CD/CRD data introduced measurement error into the CD/CRD models. A.R.H.

N80-15451*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE SAMPLING DESIGN
A. H. Feiveson, R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.), and C. R. Hallum, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 47-52 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The sampling design in LACIE consisted of two major components, one for wheat acreage estimation and one for wheat yield prediction. The acreage design was basically a classical survey for which the sampling unit was a 5- by 6-nautical mile segment; however, there were complications caused by measurement errors and loss of data. Yield was predicted by sampling meteorological data from weather stations within a region and then using those data as input to previously fitted regression equations. Wheat production was not estimated directly, but was computed by multiplying yield and acreage estimates. The allocation of samples to countries is discussed as well as the allocation and selection of segments in strata/substrata. A.R.H.

N80-15452*# Lockheed Electronics Co., Houston, Tex.
LACIE AREA SAMPLING FRAME AND SAMPLE SELECTION
C. J. Liszcz, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 53-56 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Transparent acetate overlays containing agricultural boundaries within each of the LACIE countries were prepared and registered to operational navigation charts (ONC's). Full frame LANDSAT color-infrared images of the same scale as the ONC's (1:1 million) were used to identify agricultural boundaries based on discernible agricultural field patterns. Preliminary steps taken in the preparation of the base map overlay, and the construction of an overlay of the base map physical features are described as well as the construction of the agricultural and nonagricultural delineation overlay. A.R.H.

N80-15453*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE LARGE AREA ACREAGE ESTIMATION
R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.) and A. H. Feiveson, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 57-65 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

A sample wheat acreage for a large area is obtained by multiplying its small grains acreage estimate as computed by the classification and mensuration subsystem by the best available ratio of wheat to small grains acreages obtained from historical data. In the United States, as in other countries with detailed historical data, an additional level of aggregation was required because sample allocation was made at the substratum level. The essential features of the estimation procedure for LACIE countries are included along with procedures for estimating wheat acreage in the United States. A.R.H.

N80-15454*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE AREA AGGREGATION AND MEAN-SQUARED PREDICTION ERROR ESTIMATION FOR LACIE YIELD AND PRODUCTION FORECASTS
R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.) and A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 67-71 ref ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Aggregation formulas are given for production estimation of a crop type for a zone, a region, and a country, and methods for estimating yield prediction errors for the three areas are described. A procedure is included for obtaining a combined yield prediction and its mean-squared error estimate for a mixed wheat pseudozone. A.R.H.

N80-15455*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CLASSIFICATION AND MENSURATION OF LACIE SEGMENTS
R. P. Heydorn, R. M. Bizzell, J. A. Quirein (Lockheed Electronics Co., Houston, Tex.), K. M. Abotteen (Lockheed Electronics Co., Houston, Tex.), and C. A. Sumner, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 73-86 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The theory of classification methods and the functional steps in the manual training process used in the three phases of LACIE are discussed. The major problems that arose in using a procedure for manually training a classifier and a method of machine classification are discussed to reveal the motivation that led to a redesign for the third LACIE phase. A.R.H.

N80-15456*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LACIE REGISTRATION PROCESSING
Gerald J. Grebowsky, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 87-97 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The basic requirements for the LACIE processing system are to extract specified test sites (sample segments) from LANDSAT MSS data, and to apply geometric corrections and perform correlations to ensure registration between successive data acquisitions to within 1 pixel (root mean square). The general flow within the LACIE processing system is described with emphasis on (1) determination of line and pixel location of a search area within an MSS frame; (2) determination of the geometric correction coefficient and the application of geometric corrections; (3) edge detection; and (4) correlation by coincidence of edges. A.R.H.

N80-15457*# Environmental Data and Information Service, Washington, D. C.
DEVELOPMENT OF LACIE CCEA-1 WEATHER/WHEAT YIELD MODELS
N. D. Strommen, C. M. Sakamoto (Environmental Data and Information Service, Columbia, Mo.), S. K. LeDuc (Environmental Data and Information Service, Columbia, Mo.), and D. E. Umberger, Principal Investigators (USDA Economics, Statistics, and Cooperative Service, Columbia, Mo.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 99-108 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The advantages and disadvantages of the casual (phenological, dynamic, physiological), statistical regression, and analog approaches to modeling for grain yield are examined. Given LACIE's primary goal of estimating wheat production for the large areas of eight major wheat-growing regions, the statistical regression approach of correlating historical yield and climate data offered the Center for Climatic and Environmental Assessment the greatest potential return within the constraints of time and data sources. The basic equation for the first generation wheat-yield model is given. Topics discussed include truncation, trend variable, selection of weather variables, episodic events, strata selection, operational data flow, weighting, and model results. A.R.H.

N80-15458*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
GROWTH STAGE ESTIMATION
V. S. Whitehead, D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), and W. E. Crea, Principal Investigators *In its* Proc. of

Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 109-114 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Of the three candidate approaches to adjustment of the crop calendar to account for year-to-year weather differences, the Robertson triquadratic unit, a function of a nonlinear function of maximum and minimum temperature and day length, best described the rate of phenological development of wheat. The adjustable crop calendar (ACC) as implemented for LACIE is used to calculate the daily increment of development through six physiological stages of growth. Topics covered include dormancy modeling, the spring restart model, spring wheat starter model, winter starter model, winter wheat starter model, inclusion of the moisture variable, and display of crop stage estimation results. Assessment of the ACC accuracy over the period of LACIE operation indicates that the adjustable crop calendars used provided more accurate information than would have been available using historical norms. The models performed best under the conditions from which they were derived (Canadian spring wheat) and most poorly for the dwarf varieties and Southern Hemisphere applications. A.R.H.

N80-15459*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACCURACY ASSESSMENT: THE STATISTICAL APPROACH TO PERFORMANCE EVALUATION IN LACIE
A. G. Houston, A. H. Feiveson, R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.), and E. N. Hsu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 115-130 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

A statistical methodology was developed to check the accuracy of the products of the experimental operations throughout crop growth and to determine whether the procedures are adequate to accomplish the desired accuracy and reliability goals. It has allowed the identification and isolation of key problems in wheat area yield estimation, some of which have been corrected and some of which remain to be resolved. The major unresolved problem in accuracy assessment is that of precisely estimating the bias of the LACIE production estimator. Topics covered include: (1) evaluation techniques; (2) variance and bias estimation for the wheat production estimate; (3) the 90/90 evaluation; (4) comparison of the LACIE estimate with reference standards; and (5) first and second order error source investigations. A.R.H.

N80-15460*# California Univ. at Berkeley.
MANUAL INTERPRETATION OF LANDSAT DATA
C. M. Hay, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 131-146 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The task of the analyst throughout LACIE phases 1 and 2 consisted of outlining representative areas (fields) for all spectral classes within a segment on the basis of their appearance on the LANDSAT image products, and then labeling the crop type (wheat/nonwheat) within the selected training areas. For LACIE phase 3, a procedure was developed and implemented which incorporated clustering for spectral class definition and training statistics generation. The only analyst's task was crop type identification. The logical processes involved in interpretation are described, rather than a step-by-step description of analyst procedures. A.R.H.

N80-15461*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ACQUISITION AND PREPROCESSING OF LANDSAT DATA
T. N. Horn (GE Space Div., Beltsville, Md.), L. E. Brown, and W. H. Anonsen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 147-155 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The original configuration of the GSFC data acquisition, preprocessing, and transmission subsystem, designed to provide LANDSAT data inputs to the LACIE system at JSC, is described. Enhancements made to support LANDSAT -2, and modifications for LANDSAT -3 are discussed. Registration performance throughout the 3 year period of LACIE operations satisfied the 1 pixel root-mean-square requirements established in 1974, with more than two of every three attempts at data registration proving successful, notwithstanding cosmetic faults or content inadequacies to which the process is inherently susceptible. The cloud/snow rejection rate experienced throughout the last 3 years has approached 50%, as expected in most LANDSAT data use situations. A.R.H.

N80-15462*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ANCILLARY DATA ACQUISITION FOR LACIE
B. E. Spiers (USDA Agricultural Stabilization and Conservation Service, Houston, Tex.) and R. L. Patterson, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 157-162 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The design, implementation, and operational functions of the three phases of LACIE supported the data needs of all other elements of the project and required several types of data in addition to LANDSAT multispectral digital data. The nonelectronic data base consisted of statistical data, printed reports, periodicals, ground observed data received from intensive test sites and operational segments, and full-frame multispectral scanner CIR photographs. The following data were collected for the test sites in the United States and Canada: land use inventories, periodic crop observations, solar radiometer measurements, rainfall, and wheat yield for selected fields. A.R.H.

N80-15463*# Lockheed Electronics Co., Houston, Tex.
LACIE DATA-HANDLING TECHNIQUES
G. H. Waits, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 163-167 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Techniques implemented to facilitate processing of LANDSAT multispectral data between 1975 and 1978 are described. The data that were handled during the large area crop inventory experiment and the storage mechanisms used for the various types of data are defined. The overall data flow, from the placing of the LANDSAT orders through the actual analysis of the data set, is discussed. An overview is provided of the status and tracking system that was developed and of the data base maintenance and operational task. The archiving of the LACIE data is explained. Author

N80-15464*# Lockheed Electronics Co., Houston, Tex.
THE ACQUISITION, STORAGE, AND DISSEMINATION OF LANDSAT AND OTHER LACIE SUPPORT DATA
L. F. Abbotts and R. M. Nelson, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 169-177 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Activities performed at the LACIE physical data library are described. These include the researching, acquisition, indexing, maintenance, distribution, tracking, and control of LACIE operational data and documents. Much of the data available can be incorporated into an Earth resources data base. Elements of the data collection that can support future remote sensing programs include: (1) the LANDSAT full-frame image files; (2) the microfilm file of aerial and space photographic and multispectral maps and charts that encompasses a large portion of the Earth's surface; (3) the map/chart collection that includes various scale maps and charts for a good portion of the U.S. and the LACIE area in foreign countries; (4) computer-compatible tapes of good quality LANDSAT scenes; (5) basic remote sensing data, project data, reference material, and associated publications; (6) visual aids to support presentation on remote sensing projects; and (7) research acquisition and handling procedures for managing data. A.R.H.

N80-15465*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE CLASSIFICATION AND MENSURATION SUBSYSTEM

K. M. Abotteen (Lockheed Electronics Co., Houston, Tex.) and R. M. Bizzell, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 179-201 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

From an operational standpoint, the most significant item the classification and mensuration subsystem (CAMS) had to overcome in providing the acreage component of the wheat production estimates for LACIE was the scope (segment volume processing required). Peak processing requirements per day increased from 16 to 20 for phase 1 with 700 total segments, to 35 to 40 per day for phase 2 with 1700 total segments, to 75 to 80 per day for phase 3 with 3000 total segments. Key issues regarding interrelationships between man and machines were identified during phase 1 using first generation technology. Procedure 1, tested and evaluated during phase 2 and continued through the initial phase 3 processing period for winter wheat, showed the need for software modification, procedures development, and analyst training. CAMS operations are described with emphasis on the training backgrounds of the analysts, the available data, and the labeling logic. A.R.H.

N80-15466*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CONCEPTS LEADING TO THE IMAGE-100 HYBRID INTERACTIVE SYSTEM
T. F. Mackin and J. M. Sulester, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 203-209 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

As LACIE Procedure 1 evolved from the Classification and Mensuration Subsystem smallfields procedures, it became evident that two computational systems would have merit-the LACIE/Earth Resources Interactive Processing System based on a large IBM-360 computer oriented for operational use with high computational throughput, and a smaller, highly interactive system based on a PDP 11-45 minicomputer and its display system, the IMAGE-100. The latter had advantages for certain phases; notably, interactive spectral aids could be implemented quite rapidly. This would allow testing and development of Procedure 1 before its implementation on the LACIE/Earth Resources Interactive Processing System. The resulting minicomputer system, called the Classification and Mensuration Subsystem IMAGE-100 Hybrid System, allowed Procedure-1 operations to be performed interactively, except for clustering, classification, and automatic selection of best acquisitions, which were offloaded to the LACIE/Earth Resources Interactive Processing System.
Author

N80-15467*# Department of Agriculture, Houston, Tex.
USDA ANALYST REVIEW OF THE LACIE IMAGE-100 HYBRID SYSTEM TEST
P. Ashburn, K. Buelow, H. L. Hansen (USDA Soil Conservation Service, Houston, Tex.), and G. A. May, Principal Investigators (USDA Economics, Statistics, and Cooperatives Service, Houston, Tex.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 211-215 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Fifty operational segments from the U.S.S.R., 40 test segments from Canada, and 24 test segments from the United States were used to provide a wide range of geographic conditions for USDA analysts during a test to determine the effectiveness of labeling single pixel training fields (dots) using Procedure 1 on the 1-100 hybrid system, and clustering and classifying on the Earth Resources Interactive Processing System. The analysts had additional on-line capabilities such as interactive dot labeling, class or cluster map overlay flickers, and flashing of all dots of equal spectral value. Results on the 1-100 hybrid system are described and analyst problems and recommendations are discussed. A.R.H.

N80-15468*# National Oceanic and Atmospheric Administration, Houston, Tex.
OPERATION OF THE YIELD ESTIMATION SUBSYSTEM
D. G. McCrary, J. L. Rogers (USDA Federal Crop Insurance Corp., Houston, Tex.), and J. D. Hill, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 217-225 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The organization and products of the yield estimation subsystem (YES) are described with particular emphasis on meteorological data acquisition, yield estimation, crop calendars, weekly weather summaries, and project reports. During the three phases of LACIE, YES demonstrated that it is possible to use the flow of global meteorological data and provide valuable information regarding global wheat production. It was able to establish a capability to collect, in a timely manner, detailed weather data from all regions of the world, and to evaluate and convert that data into information appropriate to the project's needs. A.R.H.

N80-15469*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE CROP ASSESSMENT SUBSYSTEM: SYSTEM IMPLEMENTATION AND APPROACHES USED FOR THE GENERATION OF CROP PRODUCTION REPORTS
W. E. McAllum, R. E. Hatch (Department of Agriculture, Houston, Tex.), S. M. Bostwright (Ford Aerospace and Communications Corp., Houston, Tex.), C. J. Liszcz (Lockheed Electronics Co., Houston, Tex.), and S. M. Evans, Principal Investigators (Department of Agriculture, Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 227-241 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The primary responsibility of the crop assessment subsystem (CAS) during the three phases of LACIE was to produce crop reports that included estimates of wheat area, yield, and production, as well as a specified set of associated statistical descriptors. The operations of CAS are described with emphasis on sampling strategy, input/output data, evolution of aggregation/reporting system capabilities, and CAS aggregation procedures. A.R.H.

N80-15470*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE STATUS AND TRACKING
V. M. Dauphin, C. H. Jeffress (Lockheed Electronics Co., Houston, Tex.), and J. M. Everette, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 243-248 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The operational requirements and development of a system designed to meet LACIE needs for data to be available at given stations simultaneously, to measure throughput rates, and perform efficiency analyses are described. The final automated status and tracking system (ASATS) is defined and problems encountered during its evolutionary process are discussed. A.R.H.

N80-15471*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE QUALITY ASSURANCE
G. L. Gutschewski, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 249-255 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Topics covered include (1) development of the LACIE quality assurance program; (2) LACIE quality assurance responsibilities of all organizational elements; (3) internal quality assurance support; and (4) accomplishments. A.R.H.

N80-15472*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACCURACY ASSESSMENT SYSTEM AND OPERATION
D. E. Pitts, A. G. Houston, G. Badhwar, M. J. Bender, M. L. Rader (Lockheed Electronics Co., Houston, Tex.), W. G. Eppler (Lockheed Missiles and Space Co., Palo Alto, Calif.), C. W. Ahlers (Lockheed Electronics Co., Houston, Tex.), W. P. White (Lockheed Electronics Co., Houston, Tex.), R. R. Vela, and E. M. Hsu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 265-288 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198

ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The accuracy and reliability of LACIE estimates of wheat production, area, and yield is determined at regular intervals throughout the year by the accuracy assessment subsystem which also investigates the various LACIE error sources, quantifies the errors, and relates than to their causes. Timely feedback of these error evaluations to the LACIE project was the only mechanism by which improvements in the crop estimation system could be made during the short 3 year experiment. A.R.H.

N80-15473*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE APPLICATIONS EVALUATION SYSTEM EFFICIENCY REPORT
Timothy T. White, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 281-288 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The scope of the three LACIE phases is discussed as well as the system efficiencies which had to be implemented to cope with the resulting LANDSAT data load. The methodologies used in system analysis, some of the specific data collected, and the inferences of these data and their implication on future systems are also discussed. A.R.H.

N80-15474*# Lockheed Electronics Co., Houston, Tex.
CARTOGRAPHY: LACIE'S SPATIAL PROCESSOR
M. L. Rader and R. R. Vela, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 291-296 ref Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The spatial processing needs of LACIE include the location of agricultural test sites, and the registration of ground truth to LANDSAT imagery. The technological aspects of LACIE cartographic support, the need for cartography in satellite crop surveys, and proposed improvements which would enhance support of future programs are discussed. A.R.H.

N80-15475*# IBM Federal Systems Div., Houston, Texas.
THE LACIE DATA BASES: DESIGN CONSIDERATIONS
L. E. Westberry, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 297-306 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The implementation of direct access storage devices for LACIE is discussed with emphasis on the storage and retrieval of image data. Topics covered include the definition of the problem, the solution methodology (design decisions), the initial operational structure, and the modifications which were incorporated. Some conclusions and projections of future problems to be solved are also presented. A.R.H.

N80-15476*# IBM Federal Systems Div., Houston, Texas.
MAN-MACHINE INTERFACES IN LACIE/ERIPS
Barbara B. Duprey, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 307-315 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

One of the most important aspects of the interactive portion of the LACIE/ERIPS software system is the way in which the analysis and decision-making capabilities of a human being are integrated with the speed and accuracy of a computer to produce a powerful analysis system. The three major man-machine interfaces in the system are (1) the use of menus for communications between the software and the interactive user; (2) the checkpoint/restart facility to recreate in one job the internal environment achieved in an earlier one; and (3) the error recovery capability which would normally cause job termination. This interactive system, which executes on an IBM 360/75 mainframe, was adapted for use in noninteractive (batch) mode. A case study is presented to show how the interfaces work in practice by defining some fields based on an image screen display, noting the field definitions, and obtaining a film product of the classification map. A.R.H.

N80-15477*# IBM Federal Systems Div., Houston, Texas.
LACIE/ERIPS SOFTWARE SYSTEM SUMMARY
C. L. Johnson, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 317-332 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The Earth resources interactive processing system (ERIPS) supports LACIE by classifying LANDSAT sensed data on the basis of the statistical similarity to those portions which were identified by analysts. The development and capabilities of the ERIPS software system are described with emphasis on (1) system requirements; (2) LACIE/ERIPS hardware; (3) system functions; (4) pattern recognition concept; and (5) LACIE/ERIPS data bases. Algorithms used in LACIE/ERIPS for statistics, divergence, feature selection, classification, registration, adaptive clustering, iterative clustering, clustering report functions, Sun angle correction, mean level adjustment, and bias correction are appended. A.R.H.

N80-15478*# Lockheed Electronics Co., Houston, Tex.
CONSIDERATIONS FOR DESIGN OF FUTURE RESEARCH AND DEVELOPMENT INTERACTIVE IMAGE ANALYSIS SYSTEMS
T. B. Wilkinson, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 333-344 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Future interactive image analysis systems must provide for the increased processing requirements imposed by a thermal channel to LANDSAT-3 and the increased number of spectral channels with significantly higher spatial resolution provided by the LANDSAT-D thematic mapper. Other design considerations must include the rapidly changing technology in memories and special purpose processors, as well as the analyst-machine interface and the human factors involved. The centralized and distributed system approaches are examined in relation to the optimum design configuration of future systems. A.R.H.

N80-15479*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
VERY HIGH SPEED PROCESSING: APPLICABILITY OF PERIPHERAL DEVICES TO PIXEL-DEPENDENT TASKS
J. C. Lyon, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 345-354 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Early options studied in the satisfaction of LACIE implementation computational demands are described as well as the ultimate selection and development of an array processing solution to the problem. The economic justification, as a function of required LANDSAT analysis, is provided. The suitability of such processors for LACIE and other applications is discussed. A.R.H.

N80-15480*# IBM Federal Systems Div., Houston, Texas.
A LOOK AT COMPUTER SYSTEM SELECTION CRITERIA
E. W. Poole, F. L. Flowers, and W. I. Stanley, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 355-396 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

There is no difficulty in identifying the criteria involved in the computer selection process; complexity arises in objectively evaluating various candidate configurations against the criteria, based on the user's specific needs. A model for formalizing the selection process consists of two major steps: verifying that the candidate configuration is adequate to the user's programming requirements, and determining an overall system evaluation rating based on cost, usability, adaptability, and availability. A 36 step instruction for computer sizing evaluation is included in the appendix along with a sample application of the configuration adequacy model. Selection criteria and the weighting process are also discussed. A.R.H.

N80-15481*# Mitre Corp., Houston, Tex.
COST AND PERFORMANCE CHARACTERISTICS OF DATA SYSTEM CONFIGURATIONS FOR PROCESSING REMOTELY SENSED DATA
P. J. Gregor and J. F. Spitzer, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 397-408 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Some alternative approaches to constructing a large remote-sensing data system are explored. The cost and performance implications of using a collection of 'small' computers versus using one large computer are examined. Several architectures and associated costs for the large data system supporting a single data center are presented. Recurring cost factors (maintenance and operations) currently slightly favor the single large-machine architecture, but other factors may dictate the choice of one of the two multimachine architectures discussed. A.R.H.

N80-15482*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE LACIE CROP YEARS: AN ASSESSMENT OF THE CROP CONDITIONS EXPERIENCED IN THE THREE YEARS OF LACIE
J. D. Hill (NOAA Environmental Data and Information Service, Houston, Tex.) and D. R. Thompson, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 411-429 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Meteorological data and LANDSAT spectral data from growing regions in the U.S. Great Plains, the U.S.S.R., and Canada were used to assess growing conditions and to document where anomalies such as drought, floods, and freezes were impacting the crop yield and appearance of spring and winter wheat. In the United States, the weekly rainfall and temperature data were used to estimate soil moisture, which was then related to crop needs by a crop moisture index. The transformation of LANDSAT digital data into a green index number provided a procedure whereby data from a LACIE segment could be classified as drought affected or not. The growing seasons encountered in each LACIE country during the three phases are described. A.R.H.

N80-15483*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPLICATION OF LANDSAT DIGITAL DATA FOR MONITORING DROUGHT
D. R. Thompson and O. A. Wehmanen, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 431-438 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

A technique utilizing transformed LANDSAT digital data for detection of agricultural vegetative water stress was developed during the 1976 South Dakota drought, and expanded to the U.S. Great Plains the following year to evaluate its effectiveness in detecting and monitoring vegetative stress water stress over large areas. This technique, the green index number (GIN), indicated when the vegetation within a segment was undergoing stress. Segments were classified as either moisture-stressed or normal using remote sensing techniques combined with a knowledge of crop condition. The remote sensing-based information was compared to a weekly ground-based index (the crop moisture index) provided by the U.S. Dept. of Commerce. The approaches used and the results from the GIN monitoring program are presented. A.R.H.

N80-15484*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: U.S. GREAT PLAINS
Duane L. Marquis, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 439-479 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The accuracy and reliability of the LACIE design was tested using the nine states of the U.S. Great Plains where comparison data was available. The three phases of LACIE are discussed with respect to the scope; sampling; LANDSAT data; estimates of area, yield, and production; accuracy of the estimates; and technical issues related to each phase. A.R.H.

N80-15485*# Department of Agriculture, Houston, Tex.
LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: U.S.S.R.
J. R. Hickman, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 481-512 ref ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

No estimates were generated for the U.S.S.R. during LACIE phase 1. Phase 2 effort was limited to two indicator regions: winter wheat areas where 385 segments were allocated, and spring wheat areas with 362 allocated segments. The level of activity for phase 3 was extended to the entire country which automatically increased the segment workload from 747 to 1947 segments. Production, area, and yield estimates, and their accuracy are discussed for phases 2 and 3 with emphasis on scope, sampling strategy, data base, LANDSAT data, yield analysis for winter and spring wheat, area and production analysis for winter and spring wheat, and technical issues and problems. A.R.H.

N80-15486*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: CANADA
Delanne Conte (USDA Foreign Agricultural Service, Houston, Tex.), A. G. Houston, and L. O. Lovfald, Principal Investigators (USDA Economics, Statistics, and Cooperatives Service, Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 513-526 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Sampling segment allocation for Canada placed 283 segments within three provinces: Saskatchewan (170), Alberta (75), and Manitoba (38). The data base was comprised of five data sets: allocation, historical, ratio, LANDSAT, and yield. In-season area, yield, and production estimates were generated only during phase 2. These data are presented and analyzed. A.R.H.

N80-15487*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACCURACY AND PERFORMANCE OF LACIE AREA ESTIMATES
J. F. Potter (Lockheed Electronics Co., Houston, Tex.), E. M. Hsu (Lockheed Electronics Co., Houston, Tex.), A. G. Houston, and D. E. Pitts, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 527-573 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Results for the three crop years between 1974 and 1977 are presented in 25 tables for four regions of the U.S. Great Plains. Topics covered include error source analyses and special studies during each phase. Abnormal signature and boundary problems still under investigation are examined. A.R.H.

N80-15488*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACCURACY AND PERFORMANCE OF LACIE YIELD ESTIMATES IN MAJOR WHEAT PRODUCING REGIONS OF THE WORLD
D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), R. G. Stuff, A. G. Houston, E. M. Hsu (Lockheed Electronics Co., Houston, Tex.), and M. H. Trenchard, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 575-587 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The LACIE yield models developed, implemented, and tested during the three phases of the experiment represent the first generation of models designed for the large-scale prediction of wheat production. The models are capable of supporting the

stated project goal of being within 10 percent of the actual wheat production 90 percent of the time. The limitations of the models are inherent in their nature. The temporal resolution limits their ability to handle the erratic weather occurring in critical situations. The relatively large spatial resolution of the individual models limits the capture of localized but important episodic events. A.R.H.

N80-15489*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACCURACY AND PERFORMANCE OF LACIE CROP DEVELOPMENT MODELS
S. K. Woolley (Lockheed Electronics Co., Houston, Tex.), V. S. Whitehead, R. G. Stuff, and W. E. Crea, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 589-604 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Of the three principal phenological crop calendar models evaluated for LACIE, Robertson's triquadratic model which predicts the rate of progression of wheat through its biological development, was selected. Daily maximum and minimum temperatures and day length are the input variables, and the principal output is a daily increment of development through six physiological growth stages. Because wheat corresponds differently to the environment during each growth stage, five different equations are required. The estimated and observed crop development data were compared in order to establish a measure of confidence in the model and to identify consistent discrepancies that would adversely affect LACIE operation. Although the model provided reliable estimates for various wheat growing regions of the world, it was found that there are still areas in need of further model improvement or development. A.R.H.

N80-15490*# Department of Agriculture, Washington, D.C.
ECONOMIC EVALUATION: CONCEPTS, SELECTED STUDIES, SYSTEM COSTS, AND A PROPOSED PROGRAM
Frank H. Osterhoudt, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 605-616 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The more usual approaches to valuing crop information are reviewed and an integrated approach is recommended. Problems associated with implementation are examined. What has already been accomplished in the economic evaluation of LACIE-type information is reported including various studies of benefits. The costs of the existing and proposed systems are considered. A method and approach is proposed for further studies. A.R.H.

N80-15491*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHODS FOR SEGMENT WHEAT AREA ESTIMATION
R. P. Heydorn, M. C. Trichel, and J. D. Erickson, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 621-632 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The major research conducted during the three years of LACIE to solve problems associated with segment wheat area estimation is reviewed. Topics covered include proportion estimation, clustering, feature extraction, and signature extension. It would appear that LANDSAT-1 and LANDSAT-2 data do not contain enough information to discriminate between crop types perfectly all the time and, therefore, a basic problem arises when no ground truth data on crop types in the area are available. New approaches are needed to reduce labeling error. Perhaps better use of multiyear LANDSAT data, a more detailed understanding of the cropping practices in the area, better crop calendar prediction, and a better understanding of the limiting sources of error in LANDSAT data related to crop discrimination may provide the insight required to develop improved designs. A.R.H.

N80-15492*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ESTIMATING CROP PROPORTIONS FROM REMOTELY SENSED DATA
A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 633-646 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The classification/pixel-count method for estimating the proportion of wheat in each segment is theoretically biased even if all distributional assumptions are met. Alternative ways to estimate crop proportions are examined and their performance testing is considered. Topics covered include general linear functional estimates, the method of moments, and maximum likelihood estimators. A.R.H.

N80-15493*# Texas A&M Univ., College Station.
ON THE CLUSTERING OF MULTIDIMENSIONAL PICTORIAL DATA
J. D. Bryant, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 647-659 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-15448 06-43)
(Contract NAS9-14689)
Avail: NTIS HC A99/MF A01 CSCL 02C

Obvious approaches to reducing the cost (in computer resources) of applying current clustering techniques to the problem of remote sensing are discussed. The use of spatial information in finding fields and in classifying mixture pixels is examined, and the AMOEBA clustering program is described. Internally, a pattern recognition program, from without, AMOEBA appears to be an unsupervised clustering program. It is fast and automatic. No choices (such as arbitrary thresholds to set split/combine sequences) need be made. The problem of finding the number of clusters is solved automatically. At the conclusion of the program, all points in the scene are classified; however, a provision is included for a reject classification of some points which, within the theoretical framework, cannot rationally be assigned to any cluster. A.R.H.

N80-15494*# Lockheed Electronics Co., Houston, Tex.
ON EVALUATING CLUSTERING PROCEDURES FOR USE IN CLASSIFICATION
M. D. Pore, T. E. Moritz, D. T. Register, S. S. Yao, and W. G. Eppler, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 661-669 refs ERTS (For primary document see N80-15448 06-43)
(Contract NAS9-15200)
Avail: NTIS HC A99/MF A01 CSCL 02C

The problem of evaluating clustering algorithms and their respective computer programs for use in a preprocessing step for classification is addressed. In clustering for classification the probability of correct classification is suggested as the ultimate measure of accuracy on training data. A means of implementing this criterion and a measure of cluster purity are discussed. Examples are given. A procedure for cluster labeling that is based on cluster purity and sample size is presented. A.R.H.

N80-15495*# Lockheed Electronics Co., Houston, Tex.
CLASSY: AN ADAPTIVE MAXIMUM LIKELIHOOD CLUSTERING ALGORITHM
R. K. Lennington and M. E. Rassbach, Principal Investigators (Elogic, Inc., Houston, Tex.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 671-689 refs ERTS (For primary document see N80-15448 06-43)
(Contract NAS9-15200)
Avail: NTIS HC A99/MF A01 CSCL 02C

The CLASSY clustering method alternates maximum likelihood iterative techniques for estimating the parameters of a mixture distribution with an adaptive procedure for splitting, combining, and eliminating the resultant components of the mixture. The adaptive procedure is based on maximizing the fit of a mixture of multivariate normal distributions to the observed data using its first through fourth central moments. It generates estimates of the number of multivariate normal components in the mixture as well as the proportion, mean vector, and covariance matrix for each component. The basic mathematical model for CLASSY and the actual operation of the algorithm as currently implemented are described. Results of applying CLASSY to real and simulated LANDSAT data are presented and compared with those generated

by the iterative self-organizing clustering system algorithm on the same data sets. A.R.H.

N80-15496*# Houston Univ., Tex.
LINEAR FEATURE SELECTION WITH APPLICATIONS
H. P. Decell, Jr. and L. F. Guseman, Jr., Principal Investigators (Texas A and M Univ., College Station) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 691-703 refs ERTS (For primary document see N80-15448 06-43)
(Contracts NAS9-15000; NAS9-14689)
Avail: NTIS HC A99/MF A01 CSCL 02C

Several ways in which feature selection techniques were used in LACIE are discussed. In all cases, the methods require some a priori information and assumptions; in most, the classification procedure (Bayes optimal) was chosen in advance. The transformations used for dimensionality reduction are linear, that is, the variables in feature space are always linear combinations of the original measurements. Several numerically tractable criteria developed for LACIE, which provide information about the probability of misclassification, are discussed. Recent results on linear feature selection techniques are included. Their use in LACIE is discussed. Related open questions are mentioned. A.R.H.

N80-15497*# Environmental Research Inst. of Michigan, Ann Arbor.
FEATURE EXTRACTION APPLIED TO AGRICULTURAL CROPS AS SEEN BY LANDSAT
R. J. Kauth, P. F. Lambeck, W. Richardson, G. S. Thomas, and A. P. Pentland, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 705-721 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The physical interpretation of the spectral-temporal structure of LANDSAT data can be conveniently described in terms of a graphic descriptive model called the Tassled Cap. This model has been a source of development not only in crop-related feature extraction, but also for data screening and for haze effects correction. Following its qualitative description and an indication of its applications, the model is used to analyze several feature extraction algorithms. A.R.H.

N80-15498*# Environmental Research Inst. of Michigan, Ann Arbor.
COMPENSATION FOR ATMOSPHERIC EFFECTS IN LANDSAT DATA
P. F. Lambeck and J. F. Potter, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 723-738 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Preprocessing algorithms were developed to remove or reduce the variations in multispectral data caused by variations in Sun angle and by changes in the atmospheric aerosol and water vapor levels. The two most significant algorithms developed by using mathematical models to define interrelations between the required multiplicative and additive correction factors so that just a few statistical characteristics of a LANDSAT distribution model would be sufficient to drive the mathematical model and to calculate the preprocessing corrections are examined. These are the atmospheric correction (ATCOR) computer program and the XSTAR haze correction algorithm. Neither the ATCOR nor the XSTAR algorithm provides an explicit compensation for the effects of changing LANDSAT view angle. Development efforts are underway to address this aspect of the preprocessing problem. A.R.H.

N80-15499*# California Univ. at Berkeley.
DEVELOPMENT OF PARTITIONING AS AN AID TO SPECTRAL SIGNATURE EXTENSION
R. W. Thomas, C. M. Hay, and J. C. Claydon, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 739-755 refs ERTS (For primary document see N80-15448 06-43)
(Contract NAS9-14565)
Avail: NTIS HC A99/MF A01 CSCL 02C

Lists of spectrally similar LACIE sample segments may be constructed with the use of three basic information types: static, seasonal, and pass-specific variables. All are related directly or indirectly to spectral signature behavior and can be used to define spatial domains over which crop-specific signatures should be extendable. Topics covered include: (1) static spectral stratification; (2) evaluation of static partitions relative to variance control objectives; (3) evaluation of the relative importance of static versus seasonal and pass-specific partitioning variables in spectral variability; and (4) a current perspective on partitioning. A.R.H.

N80-15500*# Lockheed Electronics Co., Houston, Tex.
METHODS OF EXTENDING CROP SIGNATURES FROM ONE AREA TO ANOTHER
T. C. Minter, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 757-800 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Efforts to develop a technology for signature extension during LACIE phases 1 and 2 are described. A number of haze and Sun angle correction procedures were developed and tested. These included the ROOSTER and OSCAR cluster-matching algorithms and their modifications, the MLEST and UHMLE maximum likelihood estimation procedures, and the ATCOR procedure. All these algorithms were tested on simulated data and consecutive-day LANDSAT imagery. The ATCOR, OSCAR, and MLEST algorithms were also tested for their capability to geographically extend signatures using LANDSAT imagery. Author

N80-15501*# Environmental Research Inst. of Michigan, Ann Arbor.
SIGNATURE EXTENSION METHODS IN CROP AREA ESTIMATION
R. J. Kauth and W. Richardson, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 801-823 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The Procedure B multispectral processing system is both multisegment and multistratum. It uses data from several LACIE-sized segments together and makes a proportion estimate for the entire group of segments as well as for the individual segments. In the clustering of data features, Procedure B produces multiple classes or strata rather than just two strata (as in Procedure 1), and performs stratified sampling on each of these mutliple strata in order to make a proportion estimate. Tests results for the components and for the overall performance of Procedure B are presented, and conclusions that can be drawn from these tests are discussed. The rationale for signature extension for crop area estimation is summarized. A.R.H.

N80-15502*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN EVALUATION OF PROCEDURE 1
S. G. Wheeler (IBM, Houston, Tex.), R. P. Heydorn, P. N. Misra (IBM, Houston, Tex.), W. Lee, Jr. (IBM, Houston, Tex.), and R. T. Smart, Principal Investigators (IBM, Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 825-842 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

LACIE Procedure 1 has undergone continuous testing and evaluation, starting with analytical and experimental studies even before it was implemented in ERIPS software and continuing to the present with performance evaluations using blind-site data. The strengths and weaknesses of the procedure are indicated and some areas for possible improvement are identified. Results from three of the experiments performed and an evaluation of LACIE Procedure 1 proportion estimates for some blind-site segments are discussed. A.R.H.

N80-15503*# Department of Agriculture, Houston, Tex. Foreign Agricultural Service.
THE VEGETATIVE INDEX NUMBER AND CROP IDENTIFICATION
P. Ashburn, Principal Investigator *In* NASA. Johnson Space

Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 843-855 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-15448 06-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

A vegetative index number of numerical value was calculated from the digital values of the LANDSAT system to provide some measure of green growing vegetation. The usefulness of the green numbers for schemes in crop identification and acreage estimation is investigated and the Ashburn vegetation index (AVI) is compared with the Kauth-Thomas vegetation index (KVI) for crop identification schemes. Results of wheat acreage estimation using LACIE Procedure 1 and the AVI for eight sample segments are given. Tables show comparisons between the AVI and the KVI as well as visual results of the AVI. A.R.H.

N80-15504*# California Univ. at Berkeley.

MANUAL LANDSAT DATA ANALYSIS FOR CROP TYPE IDENTIFICATION

C. M. Hay, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 857-866 ref ERTS (For primary document see N80-15448 06-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

The process of manual identification of crop type by human analysts and problems associated in LACIE that were associated with manual crop identification measurement procedures are described. Research undertaken in cooperation with LACIE operations by the supporting research community to effect solutions to, or obtain greater understanding of the problems is discussed. A.R.H.

N80-15505*# Lockheed Electronics Co., Houston, Tex.

LACIE ANALYST INTERPRETATION KEYS

J. G. Baron, R. W. Payne, and W. F. Palmer, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 867-886 ref Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-15448 06-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

Two interpretation aids, 'The Image Analysis Guide for Wheat/Small Grains Inventories' and 'The United States and Canadian Great Plains Regional Keys', were developed during LACIE phase 2 and implemented during phase 3 in order to provide analysts with a better understanding of the expected ranges in color variation of signatures for individual biostages and of the temporal sequences of LANDSAT signatures. The keys were tested using operational LACIE data, and the results demonstrate that their use provides improved labeling accuracy in all analyst experience groupings, in all geographic areas within the U.S. Great Plains, and during all periods of crop development. A.R.H.

N80-15506*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

COLORIMETRIC CONSIDERATION OF TRANSPARENCIES FOR A TYPICAL LACIE SCENE

R. D. Juday, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 887-897 ERTS (For primary document see N80-15448 06-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

The production film converter used to produce LACIE imagery is described as well as schemes designed to provide the analyst with operational film products. Two of these products are discussed from the standpoint of color theory. Colorimetric terminology is defined and the mathematical calculations are given. Topics covered include (1) history of product 1 and 3 algorithm development; (2) colorimetric assumptions for product 1 and 3 algorithms; (3) qualitative results from a colorimetric analysis of a typical LACIE scene; and (4) image-to-image color stability. A.R.H.

N80-15507*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

GENERATION OF UNIFORM CHROMATICITY SCALE IMAGERY FROM LANDSAT DATA

R. D. Juday, F. Johnson, R. A. Abotteen (Lockheed Electronics Co., Houston, Tex.), and M. D. Pore, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 899-910 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-15448 06-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

An algorithm is presented for generating uniform chromaticity scale (UCS) imagery from multispectral data. A computer program was written to implement the algorithm, and UCS film products were generated. The colors in the film and their temporal change are consistent with those expected for the particular scaling of Krauth components into the (lab) color space. The film product was not subjected to the practical test of competing with previous transformations. Preliminary examination indicates that the product offers the following possibilities: (1) a single film product that will supplant two film products in current use; (2) improved visibility of data differences in regions in data space that are critical to crop identification; and (3) an analytic route to the determination of data-space transformations that will be optimal for particular discrimination problems. A.R.H.

N80-15508*# Lockheed Electronics Co., Houston, Tex.

IMAGE AND NUMERICAL DISPLAY AIDS FOR MANUAL INTERPRETATION

R. A. Abotteen, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 911-921 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N80-15448 06-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

Four color image display techniques, developed to aid in interpreting LANDSAT imagery, are described. These are the cluster image, the principal component transformation, the principal component greenness transformation, and the color-coded spectral plot. Experimental results show that the four techniques are useful in selecting and/or identifying representative samples of signatures in a given LANDSAT scene. A.R.H.

N80-15509*# Lockheed Electronics Co., Houston, Tex.

A PROGRAMMED LABELING APPROACH TO IMAGE INTERPRETATION

M. D. Pore and R. A. Abotteen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 923-935 refs ERTS (For primary document see N80-15448 06-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

Manual labeling techniques require the analyst-interpreter to use not only production film converter products but also agricultural and meteorological data and spectral aids in an integrated, judgmental fashion. To control an anticipated high variance in these techniques, a semiautomatic labeling technology was developed. The product of this technology is label identification from statistical tabulation (LIST) which operates from a discriminant basis and has the ability to measure the reliability of the label and to introduce an arbitrary bias. The development of LIST and its properties are described. Numerical results of an application are included and the evaluation of LIST is discussed. A.R.H.

N80-15510*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

STATUS OF YIELD ESTIMATION TECHNOLOGY: A REVIEW OF SECOND-GENERATION MODEL DEVELOPMENT AND EVALUATION

R. G. Stuff, T. L. Barnett, G. O. Boatwright, D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), and V. S. Whitehead, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 937-950 ERTS (For primary document see N80-15448 06-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

Multiple regression models were studied in order to determine their yield estimation capability for any arbitrary unit area and to obtain greater responsiveness and accuracy through the use of additional data sources applied at smaller spatial and temporal scales. It was concluded that data base inadequacy

was the factor limiting performance in the models studied and that each of the models has more yield predicting capability than was reached during LACIE. K.L.

N80-15511*# Kansas State Univ., Manhattan.
A UNIVERSAL MODEL FOR ESTIMATING WHEAT YIELDS
A. M. Feyerherm and G. M. Paulsen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 951-959 refs ERTS (For primary document see N80-15448 06-43)
(Contracts NAS9-14282; NAS9-14533)
(CONTRIB-78-268-A) Avail: NTIS HC A99/MF A01 CSCL 02C

A universal wheat yield model applicable to both fall- and spring-planted wheat was developed to show separate and joint effects of weather and culture on yields. Data from state experiment stations in a wide range of climates in the U.S. Great Plains were used to build basic relationships among yields, weather, and culture. The application of the model on a macroclimatic scale in the U.S., the U.S.S.R., and India is discussed along with potential improvements. K.L.

N80-15512*# *Lockheed Electronics Co., Houston, Tex.*
THE LAW OF THE MINIMUM AND AN APPLICATION TO WHEAT YIELD ESTIMATION
R. B. Cate, D. E. Phinney, and M. H. Trenchard, Principal Investigators In NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 961-969 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The adaptation of the law of the minimum (LOM) to wheat yield estimation is discussed. It is demonstrated through a trial application that the LOM concept is a valuable tool for model building when regression tools are inadequate. K.L.

N80-15513*# National Oceanic and Atmospheric Administration, Columbia, Mo. Center for Climatic and Environmental Assessment.
CCEA SECOND-GENERATION WHEAT YIELD MODEL FOR HARD RED WHEAT IN NORTH DAKOTA
S. K. LeDuc, Principal Investigator In NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 971-979 refs Presented at the Crop Modeling Workshop, Columbia, Mo., 3-5 Oct. 1977 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The problem of estimating wheat yields for years with unusual planting dates and/or unusual phenological development is investigated. A yield model developed for hard red spring wheat in North Dakota using historical yields for crop reporting districts in conjunction with meteorological predictor variables based on weekly data is assessed. K.L.

N80-15514*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PREDICTION OF WHEAT PHENOLOGICAL DEVELOPMENT: A STATE-OF-THE-ART REVIEW
M. W. Seeley (Lockheed Electronics Co., Houston, Tex.), M. H. Trenchard (Lockheed Electronics Co., Houston, Tex.), D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), J. R. Baker, and R. G. Stuff, Principal Investigators (Fort Lewis Coll., Durango, Colo.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 981-989 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The merits and shortcomings of LACIE wheat development models are described. The effects of planting dates, spatial errors in the variables, and model forms on accuracy are discussed. K.L.

N80-15515*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NEW DEVELOPMENTS IN SAMPLING AND AGGREGATION FOR REMOTELY SENSED SURVEYS
A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 991-993 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Sampling techniques used to construct large area crop estimates are briefly reviewed. Problem areas in sampling and aggregation are covered. The natural sampling strategy, two phase sampling, weighted aggregation, and multiyear estimation are among the topics discussed. J.M.S.

N80-15516*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NATURAL SAMPLING STRATEGY
C. R. Hallum and J. P. Basu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 995-1013 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

A natural stratum-based sampling scheme and the aggregation procedures for estimating wheat area, yield, and production and their associated prediction error estimates are described. The methodology utilizes LANDSAT imagery and agrophysical data to permit an improved stratification in foreign areas by ignoring political boundaries and restratifying along boundaries that are more homogeneous with respect to the distribution of agricultural density, soil characteristics, and average climatic conditions. A summary of test results is given including a discussion of the various problems encountered. J.M.S.

N80-15517*# Texas A&M Univ., College Station.
MULTIYEAR ESTIMATES FOR THE LACIE SAMPLING PLANS
H. O. Hartley, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1015-1028 ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

An approach that may be useful in improving the estimates of the wheat acreages for the LACIE countries for each year by using the short-time series of estimates made in the sequence of consecutive years is presented. A simple 'synthesis' based method of variance component estimation is described. A general theorem concerning weighted least squares, referred to as the Aiken method, is proved. J.M.S.

N80-15518*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
WEIGHTED AGGREGATION
A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1029-1036 ref ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The use of a weighted aggregation technique to improve the precision of the overall LACIE estimate is considered. The manner in which a weighted aggregation technique is implemented given a set of weights is described. The problem of variance estimation is discussed and the question of how to obtain the weights in an operational environment is addressed. J.M.S.

N80-15519*# *National Aeronautics and Space Administration.* Lyndon B. Johnson Space Center, Houston, Tex.
DESIGN, IMPLEMENTATION, AND RESULTS OF LACIE *FIELD RESEARCH*
M. E. Bauer (Purdue Univ., Lafayette, Ind.), M. C. McEwen, W. A. Malila (ERIM, Ann Arbor, Mich.), and J. C. Harlan, Principal Investigators (Texas A and M Univ., College Station) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1037-1066 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The capability to acquire, process, and interpret remotely sensed multispectral measurements of the energy reflected and emitted from crops, soils, and other Earth surface features is considered. The LACIE Field Measurements Project is described including project objectives, the experimental approach, the data acquisition program, and selected results based on field data. The key accomplishments and results of the experiment and recommendations for future field research are summarized. J.M.S.

N80-15520*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE APPLICATION TEST SYSTEM: AN APPROACH TO TECHNOLOGY TRANSFER

A. C. Aaronson (Dept. of Agriculture, Houston, Tex.), K. Buelow (Dept. of Agriculture, Houston, Tex.), F. C. David (Dept. of Agriculture, Houston, Tex.), R. L. Packard (Dept. of Agriculture, Houston, Tex.), and F. W. Revet, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1069-1074 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The latest satellite and computer processing and analysis technologies were tested and evaluated in terms of their application feasibility. Technologies evaluated include those developed, tested, and evaluated by the LACIE, as well as candidate technologies developed by the research community and private industry. The implementation of the applications test system and the technology transfer experience between the LACIE and the applications test system is discussed highlighting the approach, the achievements, and the shortcomings. J.M.S.

N80-15521*# Department of Agriculture, Houston, Tex.
FUNCTIONAL DEFINITION AND DESIGN OF A USDA SYSTEM
S. M. Evans, E. R. Dario, and G. L. Dickinson, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1075-1084 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The fundamental definition and design of a U.S.D.A. system utilizing the LACIE technology available as of June 1976, is discussed. The organization and methods described are focused on LACIE technology in terms of its transfer for use applications. The simulation of a feasible system design provided timely answers to system design questions, such as the ability of a minicomputer to handle the proposed geometrical correction of MSS data. M.M.M.

N80-15522*# Department of Agriculture, Houston, Tex.
DATA BASE DESIGN FOR A WORLDWIDE MULTICROP INFORMATION SYSTEM
W. G. Driggers, J. M. Downs, J. R. Hickman, and R. L. Packard, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 (Jul. 1979 p 1085-1096 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

A description of the USDA Application Test System data base design approach and resources is presented. The data is described in detail by category, with emphasis on those characteristics which influenced the design most. It was concluded that the use of a generalized data base in support of crop assessment is a sound concept. The IDMS11 minicomputer base system is recommended for this purpose. M.M.M.

N80-15523*# Ford Aerospace and Communications Corp., Houston, Tex.
THE APPLICATION TEST SYSTEM: TECHNICAL APPROACH AND SYSTEM DESIGN
J. L. Benson, D. R. McClelland, J. D. Tarbet, and R. F. Purnell, Principal Investigators (Dept. of Agriculture, Houston, Tex.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1097-1101 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

An insight is provided of the technical approach which was applied to the system design of the USDA Applications Test Program. Included are: identification of requirements, assessment of remote sensing contributions, evaluations of existing techniques, and cost effective development of a system design which utilizes techniques and procedures consistent with requirements.M.M.M.

N80-15524*# Department of Agriculture, Houston, Tex.
RESOURCE MODELING: A REALITY FOR PROGRAM COST ANALYSIS
L. D. Fouts and R. L. Hurst, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jun. 1979 p 1103-1120 ref ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The approach, implementation, operation, and utilization of a model to establish capital investment and operational costs for the Program is presented. These are based on their interrelationships, dependencies, and alternative actions. M.M.M.

N80-15525*# Department of Agriculture, Houston, Tex.
THE APPLICATION TEST SYSTEM: EXPERIENCES TO DATE AND FUTURE PLANS
G. A. May, P. Ashburn, and H. L. Hansen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Session, Vol. 1 and 2 Jul. 1979 p 1121-1125 refs ERTS (For primary document see N80-15448 06-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

The ATS analysis component is presented focusing on methods by which the varied data sources are used by the ATS analyst. Analyst training and initial processing of data is discussed along with short and long plans for the ATS. M.M.M.

N80-15526*# Geological Survey, Reston, Va.
CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM, VOLUME 1 Final Report
Robert H. Alexander, Principal Investigator 26 Sep. 1979 384 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG; Proj. CARETS)
(E80-10031; NASA-CR-162442) Avail: NTIS HC A17/MF A01 CSCL 08F

The author has identified the following significant results. LANDSAT data showed the test region in 1972 to be 9% urban and built-up land, 38% agriculture, 50% forest, 3% nonforested wetlands, and less than 1% barren land, exclusive of water-covered areas. A comprehensive user evaluation revealed greatest demand for high-altitude aerial photography and the detailed maps and data products that can be derived from the metropolitan areas agencies, found relatively little use for LANDSAT imagery at 1:250,000 scale and corresponding manually interpreted land use maps.

N80-15527*# Instituto Geografico Nacional, Madrid (Spain).
THERMAL MAPPING, GEOTHERMAL SOURCE LOCATION, NATURAL EFFLUENTS AND PLANT STRESS IN THE MEDITERRANEAN COAST OF SPAIN Progress Report
Rudolfo NunezdelasCuevas, Fernando LopezdeSagredo, D. Joaquin Melia Miralles, D. Pedro Herranz Araujo, D. Jesus Paredes Perlado, D. Antonio Parrilla, D. J. Luis Picon, D. J. Luis Labrandero, and F. Gonzalez Bernaldez, Principal Investigators 30 Sep. 1979 47 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10032; NASA-CR-162443; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-15528*# Stanford Univ., Calif. School of Applied Earth Sciences.
GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A, HEAT CAPACITY MAPPING MISSION Progress Report, 1 Jul. - 30 Sep. 1979
R. J. P. Lyon and A. E. Prelat, Principal Investigators 30 Sep. 1979 2 p ERTS
(Contract NAS5-24232)
(E80-10033; NASA-CR-162444) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N80-15529*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Jul. - Sep. 1979
Helen N. Paley, Anne B. Kahle, and Stuart E. Marsh, Principal Investigators Nov. 1979 5 p ERTS
(Contract NAS7-100)
(E80-10035; NASA-CR-162446) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N80-15530*# Canada Centre for Remote Sensing, Ottawa (Ontario).
USE OF THERMAL INFRARED AND COLOUR INFRARED IMAGERY TO DETECT CROP MOISTURE STRESS Interim Report
R. C. McKenzie, N. F. Clark, and J. Cihlar, Principal Investigators Mar. 1979 36 p refs Sponsored by NASA ERTS
(E80-10036; NASA-CR-162447) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. In the presence of variable plant cover (primarily percent cover) and variable available water content, the remotely sensed apparent temperatures correlate closely with plant cover and poorly with soil water. To the extent that plant cover is not systematically related to available soil water, available water in the root zone values may not be reliably predicted from the thermal infrared data. On the other hand, if plant cover is uniform and the soil surface is shown in a minor way, the thermal data indicate plant stress and consequently available water in the soil profile.

N80-15531*# Canada Centre for Remote Sensing, Ottawa (Ontario). Applications Div.
HCMM/SOIL MOISTURE EXPERIMENT Progress Report
Josef Cihlar, Principal Investigator 31 Aug. 1979 12 p refs Sponsored by NASA ERTS
(E80-10037; NASA-CR-162448) Avail: NTIS HC A02/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-15532*# California Inst. of Tech., Pasadena.
PHYSICS OF MANTLE AND CORE MINERALS Ph.D. Thesis
Raymond Jeanloz, Principal Investigator 10 Aug. 1979 412 p refs Sponsored by NASA and NSF ERTS
(E80-10038; NASA-CR-162449) Avail: NTIS HC A16/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N80-15533*# Department of Agriculture, Phoenix, Ariz. Water Conservation Lab.
HEAT CAPACITY MAPPING MISSION (HCMM) Quarterly Progress Report, 1 Aug. - 31 Oct. 1979
Ray D. Jackson, Principal Investigator 31 Oct. 1979 1 p ERTS
(NASA Order S-40255-B)
(E80-10039; NASA-CR-162450) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-15534*# Environmental Research Inst. of Michigan, Ann Arbor.
ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 7 Jun. - 14 Sep. 1979
R. Cicone, E. Crist, Q. Holmes, R. J. Kauth, W. A. Malila, and W. Pont, Principal Investigators Oct. 1979 151 p EREP
(Contract NAS9-15476)
(E80-10040; NASA-CR-160362; ERIM-132400-28-P) Avail: NTIS HC A08/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-15535*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
DEMONSTRATION OF WETLAND VEGETATION MAPPING IN FLORIDA FROM COMPUTER-PROCESSED SATELLITE AND AIRCRAFT MULTISPECTRAL SCANNER DATA
M. Kristine Butera Oct. 1979 27 p refs
(NASA-TP-1553; S-492) Avail: NTIS HC A03/MF A01 CSCL 08B

The success of remotely mapping wetland vegetation of the southwestern coast of Florida is examined. A computerized technique to process aircraft and LANDSAT multispectral scanner data into vegetation classification maps was used. The cost effectiveness of this mapping technique was evaluated in terms of user requirements, accuracy, and cost. Results indicate that mangrove communities are classified most cost effectively by the LANDSAT technique, with an accuracy of approximately 87 percent and with a cost of approximately 3 cent per hectare compared to $46.50 per hectare for conventional ground survey methods. R.C.T.

N80-15536*# EG and G Washington Analytical Services Center, Riverdale, Md.
PRECISE RELATIVE LOCATION ESTIMATION FROM SATELLITE LASER OBSERVATIONS
Peter J. Dunn 15 Mar. 1979 19 p refs
(Contract NAS5-25028)
(NASA-CR-159953; Rept-003-79) Avail: NTIS HC A02/MF A01 CSCL 08B

Laser data from the Greenbelt, Bermuda, and Grand Turk Island tec tracking stations, and from observation at Patrick Air Force Base were used in an experiment to determine precise inter-station baselines and relative heights in short orbital arcs of no more than 12 minutes duration. The relative locations obtained are sensitive to reasonable variations in the gravity field to less than 15 cm in inter-station baseline and less than 35 cm in relative height. The formal standard deviations for range measurements at the observed 7 cm noise level are less than 10 cm for either baseline or relative height determinations from the twenty-arc combination solution. The method of data analysis is described, the baseline and relative height results are presented, and gravity model dependence is considered. A.R.H.

N80-15537*# National Aeronautics and Space Administration, Washington, D. C.
VALUE OF CROPS: QUANTITY, QUALITY AND COST PRICE
C. Meyer Dec. 1979 21 p Transl. into ENGLISH of "La Valeur des Recoltes; Quantite, Qualite, Prix de Revient", (Paris), 1969 p 41-55 Original language document was announced as N69-40768 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-75925) Avail: NTIS HC A02/MF A01 CSCL 02C

Possibilities of using algae as a nutritional supplement are examined. The nutritional value and protein content of spirulines of blue algae are discussed. A cost analysis of growing them artificially is presented. M.G.

N80-15538*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POSSIBLE METHODS FOR DISTINGUISHING ICEBERGS FROM SHIPS BY AERIAL REMOTE SENSING
Walton L. Howes Dec. 1979 36 p refs
(NASA-TM-79310; E-266) Avail: NTIS HC A03/MF A01 CSCL 08L

The simplest methods for aerial remote sensing which are least affected by atmospheric opacities are summarized. Radar is preferred for targets off the flight path, and microwave radiometry for targets along the flight path. Radar methods are classified by ability to resolve targets. Techniques which do not require target resolution are preferred. Among these techniques, polarization methods appear most promising, specifically those which differentiate the expected relatively greater depolarization by icebergs from that by ships or which detect doubly-reversed circular polarization. R.C.T.

N80-15539*# International Business Machines Corp., Gaithersburg, Md.
ON-BOARD MULTISPECTRAL CLASSIFICATION STUDY. VOLUME 2: SUPPLEMENTARY TASKS
D. Ewalt Dec. 1979 173 p refs
(Contract NAS1-15119)
(NASA-CR-159178) Avail: NTIS HC A08/MF A01 CSCL 22A

The operational tasks of the onboard multispectral classification study were defined. These tasks include: sensing characteristics for future space applications; information adaptive systems architectural approaches; data set selection criteria; and onboard functional requirements for interfacing with global positioning satellites. R.C.T.

N80-15540# Catholic Univ. of America, Washington, D. C. Dept. of Electrical Engineering.
CONCEPT DEVELOPMENT OF AUTOMATED IMAGE ANALYSIS. AUTOMATED CONTOUR RECOGNITION AND CLASSIFICATION IN AERIAL PHOTOGRAPHY BY MEANS OF ANGLES AND CURVATURE Final Report
Henning F. Harmuth 31 Aug. 1979 96 p refs
(Contract DAAK70-78-C-0147)
(AD-A074439; ETL-0194) Avail: NTIS HC A05/MF A01 CSCL 09/4

The automated contour recognition and classification in aerial photography requires a feature of contours that is invariant to shift, rotation and scaling. General polygons are characterized by their angles and their normalized sides. The normalization of the sides may be achieved by dividing either with the longest side or with the circumference of the polygon. For a curved contour, the simplest invariant under shift and rotation is the curvature. To make the curvature invariant to scaling, one may divide it by the largest curvature or multiply it with the length of the contour; the multiplication with the length of the contour is better because of the finite resolution of photographs and equipment. The principle of contour recognition and classification based on angles and curvature is worked out for practical displays that produce square patterns, such as liquid crystal or plasma tube displays. The mechanical and electronic design for experimental equipment is carried out based on a plasma tube display with 512 x 512 resolved points. GRA

N80-15541# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
REMOTE SENSING OF CROSSWIND PROFILES USING THE CORRELATION SLOPE METHOD Final Report
Richard Barakat and Tommy E. Buder Aberdeen Proving Ground, Md. BRL Jul. 1979 29 p refs
(Contract DAAD05-76-C-0730; DA Proj. 1T1-61101-A-91A)
(AD-A074848; AD-E430298; ARBRL-CR-00402) Avail: NTIS HC A03/MF A01 CSCL 04/2

The correlation slope method relates the slope of the space-time covariance function at zero lag time to the crosswind component along a path via an integral equation of the first kind through the intermediary of a function of the distance between detectors. The integral equation is inverted to find the cross-wind profile using the method of singular value decomposition. The effect of noise in the measurement of the correlation slope is considered as well as the influence of finite detector separation. Some numerical results are shown. GRA

N80-15542# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF AGRICULTURAL RESOURCES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Oct. 1973 - Sep. 1979
Audrey S. Hundemann Oct. 1979 245 p Supersedes NTIS/PS-78/0969; NTIS/PS-77/0867; NTIS/PS-76/0714; NTIS/PS-75/668; NTIS/PS-75/068
(NTIS/PS-79/0993/0; NTIS/PS-78/0969; NTIS/PS-77/0867; NTIS/PS-76/0714; NTIS/PS-75/668; NTIS/PS-75/068) Avail: NTIS HC $28.00/MF $28.00 CSCL 03D

Results of agricultural resources surveys using remote sensing techniques for crop identification, acreage measurement, land mapping, and forest density studies are discussed. A few abstracts pertain to identification of plant diseases and insect pests and fishery resource assessment. This updated bibliography contains 239 abstracts, 28 of which are new entries to the previous edition. GRA

N80-15543# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
SURVEY OF SATELLITE SENSORS AND DATA WITH APPLICATION TO OTEC RESOURCE AND OPERATIONS REQUIREMENTS
George A. Maul, Fred M. Vukovich, Mark Bushnell, and Bobby W. Crissman Mar. 1979 80 p refs
(PB-300297/9; NOAA-TM-ERL-AOML-37; NOAA-79081002) Avail: NTIS HC A05/MF A01 CSCL 22A

The existing instruments and the capability of those instruments for observing geophysical variables that contribute to surface thermal resource fluctuations, the operating environment, and the impact of an ocean thermal energy conversion plant on the ocean are summarized. It is emphasized that remote sensing is not capable at this stage in its development to independently provide all the observations necessary for measurement of a given variable. Only an integrated in situ and remotely sensed measurement system can offer high quality data needed for environmental research. GRA

N80-15544# Bureau of Mines, Denver, Colo. Mining Research Center.
THREE POTENTIAL LONGWALL MINING METHODS FOR THICK COAL SEAMS IN THE WESTERN UNITED STATES
Richard H. Otto 1979 41 p refs
(PB-299568/6; BM-IC-8792) Avail: NTIS HC A03/MF A01 CSCL 08I

Three longwall mining methods practiced in foreign countries are described. Potential for increasing underground recovery and productivity in thick coalbeds of the western United States is emphasized. The methods are multislice longwalling, longwall caving, and high-face longwalling. Foreign practices and possible application in the United States are discussed. GRA

N80-15545# Ultrasystems, Inc., Irvine, Calif.
COAL MINE COMBUSTION PRODUCTS IDENTIFICATION AND ANALYSIS: PROCECURES AND SUMMARY Final Research Report, 1 Nov. 1977 - 1 Sep. 1978
K. L. Paciorek, R. H. Kratzer, J. Kaufman, and J. H. Nakahara Sep. 1978 141 p refs
(Contract DI-BM-HO-133004)
(PB-299559/5; BM-OFR-109-79) Avail: NTIS HC A07/MF A01 CSCL 08I

The potential hazard arising from the evolution of toxic products upon thermal oxidative decomposition of compositions employed in underground mining was assessed. Testing procedures and a basis for realistic regulations for materials to be permitted in underground operations are provided. The thermal oxidative decomposition products of specific compositions were determined on a weight/weight basis and their potential toxic hazard was evaluated. R.C.T.

N80-15546# National Ocean Survey, Rockville, Md. Office of Marine Technology.
TECHNICAL PAPERS ON AIRBORNE LASER HYDROGRAPHY Technical Memorandum, Mar. - Dec. 1978
Gary C. Guenther, Robert W. L. Thomas (EG and G Washington Anal. Serv. Center, Inc., Rockville, Md.), Lowell R. Goodman, David B. Enabnit, and Robert N. Swift (EG and G Washington Anal. Serv. Center, Inc., Rockville, Md.) Feb. 1979 74 p refs
(PB-299321/0; NOAA-TM-NOS-25; NOAA-79072309) Avail: NTIS HC A04/MF A01 CSCL 08J

Early results of an experimental and theoretical investigation into the technical aspects of airborne laser bathymetry are presented in the following papers: (1) Laser Bathymetry for Near-Shore Charting Application (A Status Report); (2) Laser Hydrography; (3) Bathymetry Intercomparison: Laser vs. Acoustic; (4) Laser Application for Near-Shore Nautical Charting; (5) Laser Bathymetry for Near-Shore Charting Application (Preliminary Field Test Results); and (6) Theoretical Characterization of Bottom Returns for Bathymetric Lidar. GRA

N80-15547# Geological Survey, Reston, Va.
US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT ALEUTIAN ISLANDS NATIONAL WILDLIFE RANGE. PROJECT 8: CONSERVATION OF NATURAL AREAS AND OF THE GENETIC MATERIAL THEY CONTAIN
Janet Bonner, comp. 1979 45 p
(PB-297931/8) Avail: NTIS HC A03/MF A01 CSCL 08G

Photographs and images of biosphere reserves taken from spacecraft and aircraft provide a significant data base showing broad views and details of the landscape and are invaluable in searching for changes and trends in forest cover, water area, and other diagnostic landscape features. Each data report lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U.S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can

make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

N80-15548# Bureau of Mines, Washington, D. C.
MINERALS IN THE US ECONOMY: TEN-YEAR SUPPLY-DEMAND PROFILES FOR NONFUEL MINERAL COMMODITIES (1968-77)
May 1979 105 p
(PB-299536/3; BM-SP-5-79) Avail: NTIS HC A06/MF A01 CSCL 08I

The supply-demand diagrams and 10-year tables for nonfuel mineral commodities are presented. Essential data required by government, industry, and others to formulate policies and programs that can help assure an adequate and continuing supply of mineral raw materials are included. The 10-year data base terminates with 1977 figures because adequate world information was not available beyond that date. GRA

N80-15549# Economics, Statistics and Cooperatives Service, Washington, D. C. Statistical Research Div.
OBTAINING TIMELY CROP AREA ESTIMATES USING GROUND-GATHERED AND LANDSAT DATA
George Hanuschak, Richard Sigman, Michael Craig, Martin Ozga, and Raymond Luebbe Aug. 1979 35 p refs
(PB-300825/7; TB-1609) Avail: NTIS HC A03/MF A01 CSCL 02C

The NASA Earth resources monitoring satellites, LANDSAT 2 and 3, were used with conventional ground-gathered data to estimate planted crop areas for the 1978 Iowa corn and soybean crops. Estimates that used LANDSAT data and ground data jointly were substantially more precise than those made from ground data alone. These estimates were one of several data sources used in determining the official year-end Annual Crop Summary for Iowa. Problems associated with total project cost, timely delivery of LANDSAT data to the USDA, and cloud cover must be solved prior to any planning for an operational program. GRA

N80-15550# Geological Survey, Tucson, Ariz.
STATISTICAL SUMMARIES OF ARIZONA STREAMFLOW DATA
T. W. Anderson and Natalie D. White Jan. 1979 422 p Prepared jointly with Arizona Water Comm., Phoenix
(PB-299354/1; USGS/WRI-79/5) Avail: NTIS HC A18/MF A01 CSCL 08H

Streamflow data for 143 gaging stations in Arizona are presented in tables. Statistical summaries are given for all active streamflow-gaging stations at which flow is unregulated, for discontinued stations that have at least 5 years of record, and for a few stations at which the flow is partly regulated. The summaries include log-Pearson Type III flood-frequency data for selected streamflow-gaging stations, annual peak discharges and gage heights and annual volumes, duration tables of daily discharges, lowest mean discharges, highest mean discharges, statistics on normal monthly mean discharges, and statistics on normal annual mean discharges. GRA

N80-15551# Hydrocomp, Inc., Palo Alto, Calif.
WATERSHED EROSION AND SEDIMENT TRANSPORT MODEL Final Report, Jul. 1975 - Jun. 1977
K. M. Leytham and R. C. Johanson Mar. 1979 373 p refs (Grant EPA-R-803726-01)
(PB-299070/3; EPA-600/3-79-028) Avail: NTIS HC A16/MF A01 CSCL 08H

The development and initial testing of the Watershed Erosion and Sediment Transport (WEST) Model is described. The movement of water and sediment through a channel system is simulated using the CHANL model. In the CHANL model the channels of a watershed are represented by a network of reaches. Hydraulic routing is performed using the kinematic wave approximation. The results are fed to the sediment algorithms which explicitly represent the processes of deposition, scour, armoring, and advection. The model is designed to handle any mixture of cohesive and cohensionless sediment. GRA

N80-15552# North Carolina Water Resources Research Inst., Raleigh.
USE OF FLUVIAL PROCESSES TO MINIMIZE ADVERSE EFFECTS OF STREAM CHANNELIZATION
Nelson R. Nunnally (North Carolina Univ., Charlotte) and Edward Keller (California Univ., Santa Barbara) Jul. 1979 128 p refs (Contract DI-14-34-0001-6103)
(PB-299934/0; UNC-WRRI-144; W79-09672; OWRT-B-089-NC(8)) Avail: NTIS HC A07/MF A01

Stream restoration, a means for restoring flow efficiency in streams that have become debris choked and eroded due to the direct or indirect actions of humans is discussed. Such degraded streams are typically characterized by debris jams, severe bank erosion, overwide channels, and heavy sediment discharge brought on by altered stream regimes, land use changes or prior channelization. Stream restoration is accomplished by removing debris jams and providing fairly uniform channel cross-sections and gradients while preserving meanders, leaving as many trees as possible along stream banks, and stabilizing banks with vegetation and riprap where necessary. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-15553*# Technical Report Services, Rocky River, Ohio.
EVALUATION OF FEASIBILITY OF PRESTRESSED CONCRETE FOR USE IN WIND TURBINE BLADES
Seymour Leiblein, D. S. Londahl, Donn B. Furlong, and Mark E. Dreier Sep. 1979 119 p refs Prepared in cooperation with Tuthill Pump Co., San Rafael, Calif. and Paragon Pacific, Inc., El Segundo, Calif.
(Contracts NAS3-20596; NAS3-30813; EX-76-I-01-1028; NASA Order C-25906)
(NASA-CR-159725; DOE/NASA/5906-79/1) Avail: NTIS HC A06/MF A01 CSCL 10B

A preliminary evaluation of the feasibility of the use of prestressed concrete as a material for low cost blades for wind turbines was conducted. A baseline blade design was achieved for an experimental wind turbine that met aerodynamic and structural requirements. Significant cost reductions were indicated for volume production. Casting of a model blade section showed no fabrication problems. Coupled dynamic analysis revealed that adverse rotor tower interactions can be significant with heavy rotor blades. R.C.T.

N80-15554*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE SOLAR CELLS: HIGH EFFICIENCY AND RADIATION DAMAGE
Henry W. Brandhorst, Jr. and Daniel T. Bernatowicz 1980 12 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81387; E-297) Avail: NTIS HC A02/MF A01 CSCL 10A

The progress and status of efforts to increase the end-of-life efficiency of solar cells for space use is assessed. High efficiency silicon solar cells, silicon solar cell radiation damage, GaAs solar cell performance and radiation damage and 30 percent devices are discussed. R.E.S.

N80-15555*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPEN-CIRCUIT VOLTAGE IMPROVEMENTS IN LOW RESISTIVITY SOLAR CELLS
M. P. Godlewski, T. M. Klucher, G. A. Mazaris, and V. G. Weizer 1980 11 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81388; E-298) Avail: NTIS HC A02/MF A01 CSCL 10A

Improvements in the open circuit voltage of 0.1 ohm-cm silicon solar cells were achieved using a multistep diffusion technique. Experimental details are given along with the results of an analysis that indicate that anomalous behavior of the electron mobility in the cell base limits attainment of higher voltages.
Author

N80-15556*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BACK SURFACE REFLECTORS FOR SOLAR CELLS
An-Ti Chai Chai 1980 10 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81390; E-300) Avail: NTIS HC A02/MF A01 CSCL 10A

Sample solar cells were fabricated to study the effects of various back surface reflectors on the device performance. They are typical 50 micrometers thick, space quality, silicon solar cells except for variations of the back contact configuration. The back surfaces of the sample cells are polished to a mirror like finish, and have either conventional full contacts or grid finger contacts. Measurements and evaluation of various metallic back surface reflectors, as well as cells with total internal reflection, are presented. Results indicate that back surface reflectors formed using a grid finger back contact are more effective reflectors than cells with full back metallization and that Au, Ag, or Cu are better back surface reflector metals than Al.
R.C.T.

N80-15557*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATION DAMAGE IN LITHIUM-COUNTERDOPED N/P SILICON SOLAR CELLS
A. M. Hermann (Tulane Univ.), C. K. Swartz, H. W. Brandhorst, Jr., and I. Weinberg 1980 13 p refs Presented at the 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81391; E-301) Avail: NTIS HC A02/MF A01 CSCL 10A

Lithium counterdoped n+/p silicon solar cells were irradiated with 1 MV electrons and their post irradiation performance and low temperature annealing properties were compared to that of the 0.35 ohm cm control cells. Cells fabricated from float zone and Czochralski grown silicon were investigated. It was found that the float zone cells exhibited superior radiation resistance compared to the control cells, while no improvement was noted for the Czochralski grown cells. Room temperature and 60 C annealing studies were conducted. The annealing was found to be a combination of first and second order kinetics for short times. It was suggested that the principal annealing mechanism was migration of lithium to a radiation induced defect with subsequent neutralization of the defect by combination with lithium. The effects of base lithium gradient were investigated. It was found that cells with negative base lithium gradients exhibited poor radiation resistance and performance compared to those with positive or no lithium gradients; the latter being preferred for overall performance and radiation resistance.
M.G.

N80-15558*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATION DAMAGE ANNEALING MECHANISMS AND POSSIBLE LOW TEMPERATURE ANNEALING IN SILICON SOLAR CELLS
Irving Weinberg and Clifford K. Swartz 1980 10 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(NASA-TM-81392; E-302) Avail: NTIS HC A02/MF A01 CSCL 10A

The defect responsible for reverse annealing in 2 ohm/cm n(+)/p silicon solar cells was identified. This defect, with energy level at e sub v + 0.30 eV was tentatively identified as a boron oxygen-vacancy complex. Results indicate that its removal could result in significant annealing for 2 ohm/cm and lower resistivity cells at temperatures as low as 200 C. These results were obtained by use of an expression derived from the Shockley-Read-Hall recombination theory which relates measured diffusion length ratios to relative defect concentrations and electron capture cross sections. The relative defect concentrations and one of the required capture cross sections are obtained from Deep Level Transient Spectroscopy. Four additional capture cross sections are obtained using diffusion length data and data from temperature dependent lifetime studied. These calculated results are in reasonable agreement with experimental data.
M.G.

N80-15559*# Solarex Corp., Rockville, Md.
ECONOMICAL SPACE POWER SYSTEMS
Joel H. Burkholder Jan. 1980 161 p refs
(Contract NAS3-21353)
(NASA-CR-159696) Avail: NTIS HC A08/MF A01 CSCL 10B

A commercial approach to design and fabrication of an economical space power system is investigated. Cost projections are based on a 2 kW space power system conceptual design taking into consideration the capability for serviceability, constraints of operation in space, and commercial production engineering approaches. A breakdown of the system design, documentation, fabrication, and reliability and quality assurance estimated costs are detailed.
M.G.

N80-15560*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CANDIDATE THERMAL ENERGY STORAGE TECHNOLOGIES FOR SOLAR INDUSTRIAL PROCESS HEAT APPLICATIONS
Edward R. Furman 1979 12 p refs Presented at Solar Industrial Process Heat Conf., Oakland, Calif., 31 Oct. - 2 Nov. 1979; sponsored by Solar Energy Res. Inst.
(Contract EC-77-A-31-1034)
(NASA-TM-81380; DOE/NASA/1034-79/6; E-285) Avail: NTIS HC A02/MF A01 CSCL 10A

A number of candidate thermal energy storage system elements were identified as having the potential for the successful application of solar industrial process heat. These elements which include storage media, containment and heat exchange are shown.
R.C.T.

N80-15561*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GLOBAL CALIBRATION OF TERRESTRIAL REFERENCE CELLS AND ERRORS INVOLVED IN USING DIFFERENT IRRADIANCE MONITORING TECHNIQUES
Henry B. Curtis 1980 12 p refs Presented at the 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE
(Contract DE-AI01-79ET-20485)
(NASA-TM-81393; DOE/NASA/20485-79/6; E-303) Avail: NTIS HC A02/MF A01 CSCL 10A

The feasibility of global calibration of terrestrial reference cells is discussed. A simple, accurate 'secondary' calibration technique based on ratios of test to reference cell currents measured in natural sunlight is described. Different techniques for monitoring incident irradiance during solar cell performance measurements are also examined and assessed, including the techniques of black-body detectors, calibrated reference cells, and the convolution of spectral response with solar irradiance.
M.G.

N80-15562*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Materials and Processes Lab.
CHARACTERIZATION OF THREE TYPES OF SILICON SOLAR CELLS FOR SEPS DEEP SPACE MISSIONS. VOLUME 1: CURRENT-VOLTAGE CHARACTERISTICS OF OCLI BSF/BSR 10 ohm-cm, AND BSR 2 ohm-cm CELLS AS A FUNCTION OF TEMPERATURE AND INTENSITY
A. F. Whitaker, S. A. Little, C. F. Smith, Jr., and V. A. Wooden Nov. 1979 93 p refs
(NASA-TM-78253) Avail: NTIS HC A05/MF A01 CSCL 10A

Three types of high performance silicon solar cells, BSF/BSR 10 ohm-cm, BSR 10 ohm-cm, and BSR 2 ohm-cm, were evaluated for their low temperature and low intensity performance. Sixteen cells of each type were subjected to ten temperatures and nine intensities. The BSF/BSR 10 ohm-cm cells provided the best performance at 1 solar constant and +25 C with an efficiency of 14.1% while the BSR 2 ohm-cm cells had the highest low temperature and low intensity performance with an efficiency of

22.2% at 0.04 solar constant and -170 C and the most consistent cell-to-cell characteristics. R.E.S.

N80-15563*# Alabama Univ., Huntsville.
A SURVEY OF PHOTOVOLTAIC SYSTEMS
Aug. 1979 213 p Sponsored in part by DOE
(Contract NAS8-31293)
(NASA-CR-150696) Avail: NTIS HC A10/MF A01 CSCL 10A

Solar photovoltaic manufacturers and suppliers are listed. Data sheets on specific products and typical operating, installation, or maintenance instructions and procedures are appended. R.E.S.

N80-15564# California Univ., Livermore. Lawrence Livermore Lab.
NOVEL SCHEME FOR MAKING CHEAP ELECTRICITY WITH NUCLEAR ENERGY
J. A. Pettibone 24 Aug. 1979 23 p refs
(Contract W-7405-eng-48)
(UCID-18153-Rev-1) Avail: NTIS HC A02/MF A01

Nuclear fuels should produce cheaper electricity than coal, considering their high specific energy and low cost. To exploit these properties, the scheme proposed here replaces the expensive reactor/steam-turbine system with an engine in which the expansion of a gas heated by a nuclear explosion raises a mass of liquid, thereby producing stored hydraulic energy. This energy could be converted to electricity by hydroelectric generation with water as the working fluid or by magnetohydrodynamic (MHD) generation with molten metal. A rough cost analysis suggests the hydroelectric system could reduce the present cost of electricity by two-thirds, and the MHD system by even more. Such cheap power would make feasible large-scale electrolysis to produce hydrogen and other fuels and chemical raw materials. DOE

N80-15565# Los Alamos Scientific Lab., N. Mex.
DECENTRALIZED SOLAR PHOTOVOLTAIC ENERGY SYSTEMS
M. C. Krupka Jun. 1979 110 p refs
(Contract W-7405-eng-36)
(LA-7866-TASE) Avail: NTIS HC A06/MF A01

A model residential photovoltaic system which utilizes a solar cell array roof shingle combination is discussed in relation to developing and generating the environmental data for decentralized solar photovoltaic systems. Material requirements, operating residuals, land requirements, water requirements, production processes, and production residuals for the systems operation are examined. Environmental, health, safety, and resource availability impacts are reported. A.W.H.

N80-15566# Sandia Labs., Albuquerque, N. Mex.
DESIGN OF PHOTOVOLTAIC SYSTEMS FOR RESIDENTIAL APPLICATIONS IN THE UNITED STATES
G. J. Jones 1979 7 p refs Presented at the Photovoltaic Solar Energy Conf., West Berlin, 23 Apr. 1979
(Contract DE-AC04-76DP-00789)
(SAND-78-2186C; CONF-790457-3) Avail: NTIS HC A02/MF A01

Photovoltaic system configurations for single family residences were analyzed to determine the optimum design. Cost effectiveness and the effect of climate on the 15 regions studied were determined as factors in the analysis. The interaction of the residential photovoltaic system with the local utility is discussed and the economic viability of onsite energy storage is examined. A.W.H.

N80-15567# Mechanical Technology, Inc., Latham, N. Y.
FREE-PISTON STIRLING ENGINE DEMONSTRATION TEST PLAN
15 Dec. 1978 52 p
(Contract EY-76-C-02-2764)
(COO-2764-T3) Avail: NTIS HC A04/MF A01

The plan for testing the demonstrator of a free-piston Stirling engine power system is presented. The test hardware is a free-piston Stirling engine prime mover driving a linear alternator. The demonstrator system is basically a modular assembly. The modules are the reciprocating alternator section, engine section, heater head insulation package assembly, and the pressure vessel. The test objective is to demonstrate a system with greater than 30 percent overall efficiency at 1 kW, 45 Hz operating conditions, and to identify and isolate engine losses to provide a basis for future engine improvements. DOE

N80-15568# California Univ., Berkeley. Lawrence Berkeley Lab.
GEOTHERMAL ENERGY DEVELOPMENT FROM THE SALTON TROUGH TO THE HIGH CASCADES
N. E. Goldstein Jan. 1979 15 p refs Presented at the 3rd Natl. Conf. and Exhibition on Technol. for Energy Conserv., Tucson, Ariz. 23-25 Jan. 1979
(Contract W-7405-eng-48)
(LBL-8703; CONF-790107-10) Avail: NTIS HC A02/MF A01

Operations at Cerro Prieto, the only water-dominated geothermal field currently generating electric power in North America, were assessed to identify potential problems which might face U.S. producers in the Imperial Valley. Geological, hydrogeological, geochemical, and geophysical characteristics of the Salton Trough were investigated, as well as those of Mt. Hood, Oregon, where drilling was conducted, as a preliminary to determining the geothermal potential of the entire Cascade Range. A.R.H.

N80-15569# EIC, Inc., Newton, Mass.
CORROSION PROTECTION OF SOLAR-COLLECTOR HEAT EXCHANGERS WITH ELECTROCHEMICALLY DEPOSITED FILMS Semiannual Report, 15 May - 30 Nov. 1978
S. B. Brummer, V. R. Koch, and G. H. Schnaper Jan. 1979 44 p refs
(Contract EM-78-C-04-4297)
(COO-4297-1; SAR-1) Avail: NTIS HC A03/MF A01

A novel corrosion protection technique is presented for the common solar collector metals: Al, Cu, and Fe as mild steel. The technique involves the potentiostatic electrochemical deposition of thin, adherent polymer films on the interior of heat exchanger tubes by application of a current in the presence of a suitable dissolved organic monomer. Tetramethylphenol (TMP) was shown to film Al/Zn samples, although complete coverage was not achieved. Copper and iron readily accommodate dimethylphenol and metaphenylenediamine as well as TMP films. As in the case of Al, holidays or cracks in the film were apparent thus precluding good corrosion protection. DOE

N80-15570# Midwest Research Inst., Golden, Colo.
SERAPH IMPLEMENTATION PLANS
J. Castle, W. Su, D. A. Dougherty, and J. D. Wright May 1979 45 p refs
(Contract EG-77-C-01-4042)
(SERI/RR-34-152) Avail: NTIS HC A03/MF A01

The Solar Energy Research and Applications in Process Heat test facility (SERAPH) will provide the capability of addressing many of the technical issues that currently hamper industrial solar thermal energy system implementation. The initial capability of producing steam will be at a rate of 900 lb/h (410 kg/h) which corresponds to an energy delivery rate of 1.5 million Btu/h (1.6 x 10 to the 6th power) at 430 F (220 C) with expansion capability to approximately 600 F (315 C). The initial system controls will be analog with supervisory and direct digital control to follow. The issues to be addressed at SERAPH will be computer predictive model validation and refinement, control strategy development, solar equipment evaluation, and the accumulation of operating and maintenance experience. A consistent theme throughout the planning and operation of SERAPH is the need to develop and follow practices that are consistent with conventional industrial operating procedures. DOE

N80-15571# Midwest Research Inst., Golden, Colo.
ALTERNATE CYCLES APPLIED TO OCEAN THERMAL ENERGY CONVERSION
B. Shelpuk and A. Lewandowski Feb. 1979 14 p refs Presented at the 11th Ann. Offshore Technol. Conf., Houston, Tex., 30 Apr. - 3 May 1979
(Contract EG-77-C-01-4042)
(SERI/TP-34-180; CONF-790444-3) Avail: NTIS HC A02/MF A01

Four open cycle OTEC concepts are described. These are: (1) single, vertical-axis turbine; (2) multiple, horizontal-axis turbine;

(3) foam lift/hydraulic turbine; and (4) mist lift/hydraulic turbine. A preliminary assessment of achievable performance is made in addition to a description of the subsystem performance objectives which would support the achievement of the full potential inherent in these concepts. The results and conclusions include a description of the research objectives, achievement of which make open cycle OTEC a viable alternative as a national energy source.
DOE

N80-15572# Ichthyological Associates, Inc., Absecon, N.J.
REVIEW OF WATER INTAKE SCREENING OPTIONS FOR COASTAL WATER USERS WITH RECOMMENDATIONS FOR OCEAN THERMAL ENERGY CONVERSION (OTEC) PLANTS
D. L. Thomas May 1979 43 p refs
(Contract W-31-109-eng-38)
(ANL/OTEC-BCM-005) Avail: NTIS HC A03/MF A01

Static screens (particularly the profile wire screen and the carrousel screen) have the potential advantage for OTEC for operating in a completely submerged state and of being cheaper to operate and maintain than traveling screens. However, there is no operational history with these static screens for large intake systems. The most promising traveling screen options for OTEC are the dual flow screens. They offer more screening surface and less head loss than through flow screens of similar size. They also have been operated in seawater for large intake systems. More detailed designs of potential OTEC plants, particularly screen wells, conduit and surge tank construction and head losses need to be determined before the best alternative intake screen can be selected.
DOE

N80-15573# Argonne National Lab., Ill.
QUALIFICATION OF ALUMINUM FOR OTEC HEAT EXCHANGERS
F. L. LaQue May 1979 32 p refs
(Contract W-31-109-eng-38)
(ANL/OTEC-BCM-003) Avail: NTIS HC A03/MF A01

Structural design criteria of aluminum tube heat exchangers to be used in OTEC are discussed. A number of aluminum alloys are considered for further study based on the requirements of the OTEC environment. The requirements include the resistance to penetration by pitting and crevice corrosion. The design considerations include the effects of vibration and fluid velocity, the dimensions of tubes, and physical properties of the tube materials and the properly related spacing of tube supports.
A.W.H.

N80-15574# Sandia Labs., Albuquerque, N. Mex.
METHODOLOGY FOR DETERMINING THE CONFIGURATION OF THE OPTIMUM SOLAR TOTAL ENERGY SYSTEM
R. R. Peters May 1979 59 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0422) Avail: NTIS HC A04/MF A01

A methodology for determining the configuration of the most economical solar total energy system (STES) for a particular application is presented. The methodology is examined by using it to design a STES for a certain function. The results are presented and the sensitivity of the system design to changes in economic parameters, system location, and limits on the amount of purchased energy are discussed.
A.W.H.

N80-15575# Sandia Labs., Albuquerque, N. Mex.
USER'S MANUAL FOR COMPUTER CODE SOLTES-1 (SIMULATOR OF LARGE THERMAL ENERGY SYSTEMS)
M. E. Fewell and N. R. Grandjean Jun. 1979 318 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1315-Rev) Avail: NTIS HC A14/MF A01

A user's manual for the computer code SOLTES-1, to be used on the CDC 6600 computer is presented. The code simulates the steady state response of thermal energy systems to time varying data such as weather and loads. The use of the code for simulation of solar power total energy systems, fossil fired power plants, nuclear fired power plants, solar energy heating and cooling, and geothermal energy systems is discussed.
A.W.H.

N80-15576# Gilbert Associates, Inc., Reading, Pa.
RESEARCH AND EVALUATION OF BIOMASS RESOURCES/CONVERSION/UTILIZATION SYSTEMS (MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL) Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1979
Y. K. Ahn, R. J. Brumberg, H. C. Chen, E. T. Nelson, R. P. Stringer, and R. C. Ballie (Environmental Energy Engineering, Inc., Morgantown, W. Va.) 1979 23 p
(Contract ET-78-C-02-5022)
(COO-5022-5) Avail: NTIS HC A02/MF A01

The development of a linear programming model to determine the mix of biomass resources an conversion processes to produce fuel is summarized. A market analysis of the need for biomass derived fuel and the regional availability of biomass resources on seasonal bases is discussed. Biomass conversion profiles (gasification, pyrolysis, and direct combustion) are discussed for 100 biomass materials. The materials include wood species, begasse, sugar cane, wheat, and rice straw.
A.W.H.

N80-15577# Sandia Labs., Albuquerque, N. Mex.
DESIGN AND PERFORMANCE OF SILICON SOLAR CELLS UNDER CONCENTRATED SUNLIGHT
H. T. Weaver and R. D. Nasby 1979 4 p refs Presented at the Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract EY-76-C-04-0789)
(SAND-79-1165C; CONF-790541-39) Avail: NTIS HC A02/MF A01

Measurements and numerical calculations of performance of silicon solar cells, designed for operation under concentrated sunlight, are presented. Two design strategies are discussed and data from cells of each type are used for comparison with theory. The calculations ignore degeneracy and high effects but include Auger and trap recombination. Experimental base lifetimes are used for modeling.
DOE

N80-15578# Sandia Labs., Albuquerque, N. Mex.
STATUS OF THE US DEPARTMENT OF ENERGY PHOTOVOLTAIC CONCENTRATOR DEVELOPMENT PROJECT
B. D. Shafer, E. C. Boes, M. W. Edenburn, and D. G. Schueler 1979 8 p refs Presented at the 1979 Photovoltaic Solar Energy Conf., West Berlin, 23 Apr. 1979
(Contract DE-AC04-76DP-00789)
(SAND-78-2187C; CONF-790457-2) Avail: NTIS HC A02/MF A01

The development of a photovoltaic concentrator technology which results in low costs, long life photovoltaic arrays at a price of less than $0.50 per peak watt is discussed. The development work in the areas of concentrator cells, concentrator modules, and complete arrays is surveyed. The various designs of the concentrator cells and concentrator modules are presented and evaluated in regard to their ability to produce cost effective energy.
A.W.H.

N80-15579# Midwest Research Inst., Golden, Colo.
APPLICATION OF MONTE CARLO TECHNIQUES TO INSOLATION CHARACTERIZATION AND PREDICTION Status Report, 1 Oct. 1978 - 1 Jun. 1979
R. Bird and R. Hulstrom Jul. 1979 20 p refs
(Contract EG-77-C-02-4042)
(SERI/RR-36-306) Avail: NTIS HC A02/MF A01

The Monte Carlo method can be used to investigate solar radiation transport through the atmosphere and its reflection from the Earth's surface. The rigorous model used allows a detailed understanding of the various aspects of the radiation field at the Earth's surface. This knowledge can be used to compare and formulate simple models that are more appropriate for work on solar applications. This report is preliminary in nature in that it is primarily a description of the Monte Carlo method itself and its applications rather than a detailed presentation of results used in solar radiation transport calculations.
DOE

N80-15580# National Climatic Center, Asheville, N. C.
INPUT DATA FOR SOLAR SYSTEMS
V. Cinquemani and R. G. Baldwin Nov. 1978 203 p refs
(Contract EX-76-I-01-1041)
(DOE/TIC-10193) Avail: NTIS HC A10/MF A01

Normals (30 year mean values) of maximum, minimum, and

average temperatures for a month or year, and of heating and cooling degree days are tabulated. Average daily values of total hemispheric (global) solar radiation on a horizontal surface were based on corrected hourly measurements for 26 stations and derived values from the corrected measurements for the remaining 222 stations. Most of the average values are based on a 24-25 year period. DOE

N80-15581# Oak Ridge National Lab., Tenn.
HEAT TRANSFER STUDIES IN SALT AND GRANITE
R. A. Just Oct. 1978 89 p refs
(Contract W-7405-eng-26)
(ORNL/ENG/TM-14) Avail: NTIS HC A05/MF A01

The feasibility of using a multi-layer terminal repository design in both salt and granite formations to store either high-level waste or spent fuel was studied. Calculations were made to determine temperature profiles within the repository and to provide an estimate of the thermal uplift that can be expected. Near-field models developed to compare temperature profiles in the regions close to the waste canisters indicate that maximum thermal gradients and maximum temperature increases could be significantly reduced by changing from a single to a multi-layer repository design. The far-field models used to provide qualitative comparisons of the maximum thermal uplift indicates that the thermal uplift is roughly proportional to the energy supplied to the formation. Changing from a single- to a multi-layer repository but keeping the area loading constant results in increased thermal uplifts. DOE

N80-15582# New Mexico Univ., Albuquerque. Dept. of Economics.
DISTRICT SPACE HEATING POTENTIAL OF LOW TEMPERATURE HYDROTHERMAL GEOTHERMAL RESOURCES IN THE SOUTHWESTERN UNITED STATES
P. K. McDevitt and C. R. Rao (New Mexico Energy Inst.) Oct. 1978 74 p refs Prepared jointly with New Mexico State Univ., Las Cruces
(Contract EC-77-S-04-3992)
(NMEI-10-1) Avail: NTIS HC A04/MF A01

A computer simulation model (GIRORA-Nonelectric) developed to study the economics of district space heating using geothermal energy is described. GIRORA-Nonelectric is a discounted cashflow investment model which evaluates the financial return on investment for space heating. The model consists of two major submodels: the exploration for and development of a geothermal anomaly by a geothermal producer, and the purchase of geothermal fluid by a district heating unit. A sensitivity analysis of the model subject to changes in physical and economic parameters is presented. The economic analysis and technological screening criteria are used to examine all the low temperature geothermal sites in Southwestern United States for economic viability for space heating application. DOE

N80-15583# Midwest Research Inst., Golden, Colo.
LOW TEMPERATURE THERMAL ENERGY STORAGE: A STATE-OF-THE-ART SURVEY
F. Baylin Jul. 1979 120 p refs
(Contract EG-77-C-01-4042)
(SERI/RR-54-164) Avail: NTIS HC A06/MF A01

The preliminary version of an analysis of activities in research, development, and demonstration of low temperature thermal energy storage (TES) technologies having applications in renewable energy systems is presented. Three major categories of thermal storage devices are considered: sensible heat; phase change materials; and reversible thermochemical reactions. Both short-term and annual thermal energy storage technologies based on principles of sensible heat are discussed. Storage media considered are water, earth, and rocks. Annual storage technologies include solar ponds, aquifers, and large tanks or beds of water, earth, or rocks. All program processes from basic research through commercialization efforts are investigated. Nongovernment-funded industrial programs and foreign efforts are outlined as well. Data describing low temperature TES activities are presented also as project descriptions. DOE

N80-15584# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
MELTING IN PHASE-CHANGE THERMAL STORAGE MEDIA
Final Report
E. M. Sparrow and J. W. Ramsey 1978 90 p refs
(Contract EY-76-S-02-2993)
(COO-2993-1) Avail: NTIS HC A05/MF A01

Research on melting caused by a tubular heat source embedded in a solid phase-change medium is presented. Separate studies were performed with the heater positioned with its axis horizontal and with its axis vertical. Both orientations were investigated because they correspond to those of proposed bulk-type storage configurations. In addition, the direction of the gravity force relative to the heating surface is different in the two cases and this causes differences in the buoyancy forces that act on the liquid generated by the melting process. Two phase-change media were employed in the experiments: (1) the eutectic mixture of sodium nitrate and sodium hydroxide--melting temperature of 244 C; and (2) naphthalene--melting temperature of 80 C. The analysis was carried out on a specific fluid or a temperature level. The experimental results encompass information on both the heat transfer coefficient at the heated surface and on the size and shape of the melt zone. DOE

N80-15585# Sandia Labs., Albuquerque, N. Mex. Fluid Mechanics and Heat Transfer Div.
EVALUATION OF THE EVACUATED SOLAR ANNULAR RECEIVERS USED AT THE MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY (MSSTF)
A. C. Ratzel Jul. 1979 56 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0983) Avail: NTIS HC A04/MF A01

A parabolic cyclindrical collector field subsystem used in tests to evaluate the vacuum integrity characteristics of ten glass to metal sealed concentric cylinder receivers is described. Tests and test results on the vacuum integrity and the collector system performance with evaluated receiver annuli and with receiver annuli maintained at atmospheric pressure are described. Heat loss reductions for different annulus gas pressures and under different receiver tube operating temperatures are presented. The collector's efficiency dependence upon operating temperature, annulus pressures, and insolation is discussed. A.W.H.

N80-15586# Higgins, Auld and Associates, Albuquerque, N. Mex.
ANALYSIS OF FIELD TEST RESULTS FOR SINGLE-AXIS-TRACKING SOLAR COLLECTOR FOUNDATIONS
H. E. Auld Jul. 1979 36 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7023) Avail: NTIS HC A03/MF A01

Five reinforced concrete cylindrical piers, typical of foundations utilized for single-axis-tracking solar collector systems, were tested to determine eccentric horizontal and vertical failure loads. The results from these tests were found to compare favorably with the results from theoretical calculations which incorporate the geotechnical parameters of the test site. Recommendations are made for the incorporation of these results into the design of foundations for future solar collector systems. DOE

N80-15587# Argonne National Lab., Ill. Components Technology Div.
STABILITY CONSIDERATIONS AND A DOUBLE-DIFFUSIVE CONVECTION MODEL FOR SOLAR PONDS
E. I. H. Lin, W. T. Sha, and S. L. Soo Apr. 1979 42 p refs Prepared jointly with Illinois Univ., Urbana.
(Contract W-31-109-eng-38)
(ANL-CT-79-34) Avail: NTIS HC A03/MF A01

A brief survey is made on the basic principles, current designs and economic advantages of salinity-gradient solar ponds as solar collectors and reservoirs. Attention is focused on the subject of stability, and pertinent existing results are summarized and discussed. Details of the derivation of three-dimensional stability criteria for thermohaline convection with linear gradients are presented. Ten key questions pertaining to stability are posed, whose answers must be sought through extensive analytical and numerical studies. Possible methods of approach toward enhancing solar-pond stability are also discussed. For the numerical studies of pond behavior and stability characteristics, a double-diffusive convection model is proposed. The model can be constructed by extending the three-dimensional thermohydrody-

namic computer code COMMIX-SA, following the necessary steps outlined, computational plans are described. DOE

N80-15588# Alabama Univ., University. Bureau of Engineering Research.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEMS DEVELOPMENT
W. J. Schaetzle and C. Everett Brett Mar. 1979 174 p refs Prepared for Argonne Natl. Lab., Ill.
(Contract W-31-109-eng-38)
(ANL/ICES-TM-30) Avail: NTIS HC A08/MF A01

The design, operation, economics, environmental impacts, and expected performance of heat pump centered integrated community energy systems are discussed in detail. DOE

N80-15589# Argonne National Lab., Ill. Energy and Environmental Systems Div.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS; SYSTEM DEVELOPMENT Interim Report
R. E. Crane (Franklin Res. Center), H. G. Lorsch (Franklin Res. Center), and R. G. Warden Feb. 1979 196 p refs
(Contract W-31-109-eng-38)
(ANL/ICES-TM-26) Avail: NTIS HC A09/MF A01

The concept of a heat pump centered integrated community energy system (HP-ICES) was explored based on a reference community located in the Northeast with a population of 10,000. Engineering and economic analyses were performed for the HP-ICES and for conventional heating/cooling systems. Sensitivity analyses were used to determine variations in results from changes in: community size; community energy density; waste heat utilization; energy cost escalation; maintenance and operating personnel; and central HP-ICES ownership. The effect of each of the critical parameters on the economic viability of HP-ICES is shown. Conditions of equal 20-year life cycle costs for HP-ICES and for conventional systems are given. DOE

N80-15590# Little (Arthur D.), Inc., Cambridge, Mass.
UTILIZATION OF WASTE HEAT FROM FEDERAL FACILITIES Final Report
Feb. 1979 182 p refs
(Contract EC-77-C-05-5523)
(ORO-5523-T1) Avail: NTIS HC A09/MF A01

The technical and economic feasibility of using waste heat from the Oak Ridge Gaseous Diffusion Plant (ORGDP), Paducah Plant, Portsmouth Gaseous Diffusion Plant (PFDP), and the Savannah River Plant (SRP) for industrial process heat, space heating, power generation, or in agriculture or aquaculture is evaluated. Recommended uses and the cost of implementing waste heat utilization near each site are discussed. The recommended uses at Oak Ridge include district heating, greenhouse heating, and heat pump enhanced temperature elevation of the ORGDP waste heat for subsequent process heat use in a textile mill. At Paducah, the recommendation is to use heat pumps to raise the waste heat temperature for preheating feedwater for a 1000 MW coal-fired power plant. At Portsmouth, greenhouse heating is recommended. At the SRP aquacultural and greenhouse, uses and utilization for power generation by means of a Rankine cycle process are recommended. DOE

N80-15591# Air Products and Chemicals, Inc., Allentown, Pa.
DEMONSTRATION OF A NITROGEN BASED CARBURIZING ATMOSPHERE: ENERGY CONSUMPTION OF THE ENDOTHERMIC GENERATOR Quarterly Report, 1 Oct. - 30 Dec. 1978
R. J. Peartree Jan. 1979 22 p
(Contract EM-78-C-01-5058)
(CONS/5058-T1; QR-1; ID-12027-1) Avail: NTIS HC A02/MF A01

The energy consumption of an endothermic generator is documented. Two different sized generators were studied and found to have basically the same energy usage characteristics. The energy consumption was found to be dependent on generator output, with less energy consumption per unit volume at higher outputs. DOE

N80-15592# Department of Energy, Washington, D. C. Energy Information Administration.
THE 1985, 1990 AND 1995 MIDTERM ENERGY MARKET MODEL RESULTS UNDER THREE SCENARIOS OF FUEL USE ACT REGULATIONS
W. D. Montgomery, III May 1979 621 p refs
(DOE/EIA-0182/2) Avail: NTIS HC A99/MF A01

The incremental impacts of the Powerplant and Industrial Fuel Use Act regulations are analyzed as a function of the stringency of the economic test under which exemptions are granted. To carry out this analysis, the Mid-Term Energy Market Model (MEMM) is used to generate projections of energy supply, demand, and price under the specified assumptions. Industrial fuel demand is modeled by using a separate fuel-choice model to determine the share of oil, gas, and coal; these shares are then imposed on the MEMM solution. For electric utilities, impacts are modeled by altering the capital costs in the MEMM submodel. Preliminary numerical results of some of the model runs are presented. DOE

N80-15593# Department of Energy, Washington, D. C. Energy Information Administration.
ENERGY SUPPLY AND DEMAND IN THE SHORT TERM: 1979 AND 1980
Jun. 1979 127 p refs
(DOE/EIA-0184/4) Avail: NTIS HC A07/MF A01

Overall energy supply and demand balances as well as a detailed discussion of the elements of end-use consumption of coal, natural gas, petroleum products, and electricity are presented. Analyses of the operations of utilities and refineries, the domestic production of coal, natural gas, crude oil, and electricity, and the supply and demand balances for each fuel are provided. Projections of domestic production as well as supply and demand balances, synthetics and imports, and projections for the electric utility sector are included for the short-term. DOE

N80-15594# Department of Energy, Washington, D. C. International Energy Analysis Div.
INTERNATIONAL ENERGY ASSESSMENT Analysis Report
W. C. Kilgore May 1979 74 p refs
(DOE/EIA-0184/1; AR/IA/79-27) Avail: NTIS HC A04/MF A01

A comprehensive assessment of the international energy situation between now and the year 1995 is given. Forecasts of energy supply and demand for each region of the world are included along with estimates of future world oil prices and a sensitivity analysis of the critical factors affecting those prices. The analysis projects that world energy consumption will rise at a rate of between 2.8 and 3.9% per year, over the forecast period, while the demand for petroleum is expected to grow at a rate of 2.0 to 3.5% per year. This growth in consumption is projected to occur during a period in which world economic activity is increasing at the rate of 3.8 to 4.6% per year, such that the estimated ratio of world energy growth to economic growth falls from its historic 1960-1976 ratio of 0.94, to a ratio of 0.71 to 0.85 over the 1976-1995 period. World oil prices are found to be highly uncertain with real prices by 1995 ranging between $16.50 and $31.50 per barrel across five projection series. DOE

N80-15595# Illinois Univ., Urbana. Office of Vice Chancellor for Research.
ENERGY OPTIMAL USE OF WASTE PAPER Final Report
T. L. Gunn Nov. 1978 188 p refs
(Contract EY-76-S-02-2893)
(COO-2893-9) Avail: NTIS HC A09/MF A01

The mix of burning and recycling of waste paper that would minimize the total US energy used to make and dispose of the 1974 production of paper is assessed. Five cases are analyzed to determine the effects of various assumptions about how the energy in wood and paper will be treated. In one case, both wood and paper are assumed to have an energy value. In another, neither wood nor paper is assumed to have an energy value. In the other three cases, paper, but not wood, is assumed to have an energy value which is utilized differently in each case. It is found in each case that it is worthwhile in terms of energy conservation to recycle as much high grade de-inking waste paper as can be collected. How much of the other grades of waste paper would be recycled depends on which of the various energy-accounting schemes is used. It is further found that the

greatest energy savings are accomplished when both wood and waste paper are acknowledged to have an energy value. DOE

N80-15596# Acres American, Inc., Buffalo, N. Y.
FEASIBILITY OF COMPRESSED AIR ENERGY STORAGE AS A PEAK SHAVING TECHNIQUE IN CALIFORNIA, VOLUME 2 Final Report
Sep. 1978 523 p refs
(Contract EY-76-C-03-1331)
(SAN-1331-T1) Avail: NTIS HC A22/MF A01

The technical, economic, and siting feasibility, on a preliminary basis, of the use of compressed air energy storage in the state of California was investigated. The analysis was performed on a parametric basis using gas turbines and combined cycle plants as a comparison. The methodology, base data, and results are presented along with the computer program used. The design sites for porous media and compensated hard rock are documented along with an alternate site for each type of plant and the plant designs for porous media and hard rock storage. Developments in gas turbine generators and CAES plant designs are projected as both technologies are expected to advance in the near term. Cost estimates and construction schedules prepared for the plant designs are presented. Results and conclusions are given. DOE

N80-15597# Institute of Gas Technology, Chicago, Ill.
APPLICATION ANALYSIS OF SOLAR TOTAL ENERGY SYSTEMS TO THE RESIDENTIAL SECTOR. VOLUME 4: MARKET PENETRATION Final Report
Jul. 1979 320 p refs
(Contract EG-77-C-04-3787; Proj. 8987)
(ALO-3787-4) Avail: NTIS HC A15/MF A01

The residential consumption of energy in each of the 11 solar total energy systems (STES) regions is given by fuel type and end-use category. The current and projected costs and availability of fossil fuels and electricity for the STES regions are reported. Projections are made concerning residential building construction and the potential market for residential STES. The effects of STES ownership options, institutional constraints, and possible government actions on market penetration potential are considered. Capital costs for two types of STES are determined, those based on organic Rankine cycle (ORC) heat engines and those based on flat plate, water-cooled photovoltaic arrays. Both types of systems utilize parabolic trough collectors. The capital cost differential between conventional and STE systems is calculated on an incremental cost per dwelling unit for comparison with projected fuel savings in the market penetration analysis. Results of a market analysis are summarized. DOE

N80-15598# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
NATIONAL PROGRAM PLAN FOR PASSIVE AND HYBRID SOLAR HEATING AND COOLING Interim Report
Jun. 1979 131 p
(DOE/CS-0089) Avail: NTIS HC A07/MF A01

A definition of a passive solar system is given, as well as background of Federal involvement in passive solar heating and cooling, program goals and objectives, and an overall implementation approach. Background information on the status of and the strategy and emphasis for technology development is provided, followed by descriptions of passive heating and passive cooling systems and an overview of task classifications for technology development. The technology utilization program is also presented. DOE

N80-15599# Utah Univ., Salt Lake City.
CONFERENCE ON PERFORMANCE MONITORING TECHNIQUES FOR EVALUATION OF SOLAR HEATING AND COOLING SYSTEMS
1978 353 p refs Conf. held in Washington, D.C., 3 Apr. 1978
(Contract EG-77-S-04-4094)
(CONF-780432) Avail: NTIS HC A16/MF A01

A general review of solar energy monitoring systems, their relationship to data users and their needs, and a methodology for developing instrumentation systems and performance evaluation techniques based on a systematic procedure for addressing the actual needs of the data user are provided. DOE

N80-15600# Sandia Labs., Albuquerque, N. Mex. Solar Technical Liaison Div.
DYNAMIC STORAGE IN SOLAR TOTAL ENERGY PROGRAMS
R. P. Stromberg 1978 27 p refs Presented at the Seminar on Solar Energy Storage, Trieste, Italy, 4 Sep. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0958C; CONF-780944-1) Avail: NTIS HC A03/MF A01

A program of research and development to establish the feasibility of the Solar Total Energy Concept is described. The major items of actual hardware are a 32 kW Midtemperature Solar Systems Test Facility at Albuquerque, NM; and two planned Large Scale Experiments at Shenandoah, GA, and Ft. Hood, TX. These programs are described with reference to current literature. DOE

N80-15601# Sandia Labs., Albuquerque, N. Mex.
DEPARTMENT OF ENERGY LARGE SOLAR CENTRAL POWER SYSTEMS SEMIANNUAL REVIEW
Nov. 1978 305 p refs Conf. held at Dallas, 19-21 Sep. 1978
(Contract EY-76-C-04-0789)
(SAND-78-8511) Avail: NTIS HC A14/MF A01

Progress in the development of large solar power systems is reported. Hydraulic stability of solar boilers, closed cycle Brayton solar thermal electric power plants, heliostat development, and central receiver systems are discussed along with distributed collectors and total energy and hybrid systems. J.M.S.

N80-15602# Sandia Labs., Albuquerque, N. Mex.
DEPARTMENT OF ENERGY LARGE SOLAR CENTRAL POWER SYSTEMS SEMIANNUAL REVIEW
May 1978 262 p refs Conf. held at Reston, Va., 21-22 Mar. 1979
(Contract EY-76-C-04-0789)
(SAND-79-8508) Avail: NTIS HC A12/MF A01

Thirty papers are presented each discussing various aspects of the large solar central power systems program. R.E.S.

N80-15603# Research Triangle Inst., Research Triangle Park, N. C.
SEA-SURFACE TEMPERATURE VARIABILITY ANALYSIS OF POTENTIAL OTEC SITES UTILIZING SATELLITE DATA Final Report
F. M. Vukovich, B. W. Crissman, M. Bushnell, and W. J. King Aug. 1978 159 p refs
(Contract EG-77-C-05-5444)
(ORO-5444-1) Avail: NTIS HC A08/MF A01

An analysis of the constancy of the sea-surface temperature in candidate locations for ocean thermal energy conversion (OTEC) siting was performed. Satellite infrared data were used to identify and locate major thermal fronts at the sea surface. These data were then used to glean certain statistics on these fronts. In situ data were used, when available, to determine temperature difference across specified thermal fronts. The study was performed in three regional locations of interest to OTEC. The specific regions are: Region I, Eastern Gulf of Mexico (bounded by 22 N to 30 N and 91 W to the west coast of Florida including the Straits of Florida); Region II, the east coast of Florida (bounded by 23 N to 32 N and the east coast of Florida to 79 W); and Region III, Puerto Rico and vicinity, (bounded by 17 to 19 N, 64 to 68 W). Results are presented and discussed. DOE

N80-15604# Ohio State Univ., Columbus. Engineering Experiment Station.
FUEL UTILIZATION IN RESIDENCES
C. Sepsy, M. F. McBride, R. S. Blanchett, and C. D. Jones Sep. 1978 251 p Presented at ASHRAE, Philadelphia, 28 Jan. - 1 Feb. 1979
(EPRI Proj. 137-1)
(EPRI-EA-894) Avail: NTIS HC A12/MF A01

A mathematical model and digital computer program were developed for accurately calculating the energy required by residential housing units on an hourly, daily, monthly, and seasonal basis. The model and program were used to establish an accurate procedure for determining the monthly and seasonal energy

requirements of all types of residential structures. The response-factor technique was used to calculate the dynamic load responses of a residential structure. The model and program take into account all the internal and external dynamic loads imposed on the structure; they were verified by extensive calculations and field measurements applied to nine residential dwelling units in the Columbus, Ohio, area. All contained conventional space heating and cooling equipment, either natural gas or electric forced-air furnaces. A dynamic model for simulating hourly attic space air temperatures was developed and incorporated in the thermal-load calculation procedures. DOE

N80-15606# Department of Energy, Washington, D. C.
NUCLEAR STRATEGY OF THE DEPARTMENT OF ENERGY
Apr. 1979 89 p
(DOE/ER-0025/D) Avail: NTIS HC A05/MF A01

An analysis of the technical and economic parameters related to the timing and future deployment of nuclear power is presented. A set of alternative nuclear strategies are presented and evaluated. The strategies involve decisions on breeder commercialization, fuel cycle development, and strengthening the nuclear option. A.W.H.

N80-15607# Wharton (E. F. A.), Inc., Philadelphia, Pa.
WHARTON ANNUAL ENERGY MODEL: DEVELOPMENT AND SIMULATION RESULTS Final Report
W. Finan and G. R. Schink Jul. 1979 93 p refs
(EPRI Proj. 440-1)
(EPRI-EA-1115) Avail: NTIS HC A05/MF A01

The energy sector of a commercially available macroeconomic model was expanded in order to develop a tool for examining future energy-economy interactions. The specific methodologies employed are described and a set of energy policy simulations using the newly expanded model is presented. DOE

N80-15607# Sandia Labs., Albuquerque, N. Mex. Exploratory Batteries Div. and Photometrics and Optical Development Div.
THERMAL MODEL OF A THERMAL BATTERY
D. M. Bush and R. L. Hughes Jul. 1979 48 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0834) Avail: NTIS HC A03/MF A01

A thermal model was developed to predict the effect of design changes, such as an increase in insulation thickness, on the temperature-time profile of the battery. The model is based on a quarter section of the battery, which is divided into a 10 x 20 grid consisting of 200 nodes. A method of calculating an effective conductivity/distance term between nodes negated the need for special boundary temperature calculations at material interfaces. A separate routine was used to account for the heat of fusion released by the buffer pellets. Actual design changes selected to check the model were internal heat generation, removal of stack end plates, new electrochemical system, increased side insulation, and internal electric heater. Results of model runs reflecting these changes are compared with temperature-time histories recorded from battery tests, and a close correlation is obtained in each case. DOE

N80-15608# Sandia Labs., Albuquerque, N. Mex.
LONG-TERM LITHIUM BATTERY TESTS
S. C. Levy Jun. 1979 16 p ref
(Contract EY-76-C-04-0789)
(SAND-79-0487) Avail: NTIS HC A02/MF A01

A six year program for testing ambient temperature in lithium batteries is discussed. Lithium sulfur dioxide cells and lithium polycarbon monofluoride cells are included in the tests. The test plan includes capacity versus rate, storage, and simulated operation. Data, taken six months into the test, is presented for storage at room temperature and capacity versus rate data is plotted for the cells. A.W.H.

N80-15609# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FLYWHEEL ENERGY STORAGE INTERFACE UNIT FOR PHOTOVOLTAIC APPLICATIONS
A. R. Millner and R. D. Hay 1979 6 p refs Presented at the Intersociety Energy Conf., Boston 5 Aug. 1979
(Contract EY-76-C-02-4094)
(COO-4094-44; CONF-790803-42) Avail: NTIS HC A02/MF A01

The design of a flywheel energy storage and conversion system is presented. The system which will serve as an interface between a solar photovoltaic array and an ac load, providing output waveform regulation as well as energy storage is evaluated. Features of the system include magnetic bearings, an ironless armature motor generator, and a low cost flywheel rotor. A preliminary economic analysis is provided. DOE

N80-15610# California Univ., Livermore. Lawrence Livermore Lab.
ANALYTICAL MODELING OF HEAT PUMP UNITS AS A DESIGN AID AND FOR PERFORMANCE PREDICTION M.S. Thesis - Calif. Univ., Berkeley
Jack Edwin Flower 8 Dec. 1978 149 p refs
(Contract W-7405-eng-48)
(UCRL-52618) Avail: NTIS HC A07/MF A01

Three computer programs for simulating the operating characteristics of heat pump units are described. Program THERMO calculates heat pump performance coefficients of idealized units based purely on thermodynamic considerations. Program DESIGN computes heat exchanger size requirements and operating information for a desired heat pump cycle based on input saturation temperatures in the evaporator and condenser, and heat exchanger configuration. Program PREDICT enables a model of the operation of an existing or proposed heat pump unit, given certain physical dimensions, to be designed. DOE

N80-15611# Argonne National Lab., Ill. Chemical Engineering Div.
LITHIUM/IRON SULFIDE BATTERIES FOR ELECTRIC VEHICLES
P. A. Nelson, A. A. Chilenskas, and R. K. Steunenberg 1978 24 p refs Presented at the 5th Intern. Electric Vehicle Symp., Philadelphia, 2-5 Oct. 1978
(Contract W-31-109-eng-38)
(CONF-781006-2) Avail: NTIS HC A02/MF A01

Recent progress in the development of LiAl/FeS/sub x/ batteries for electric vehicles is assessed. The possibility of near-term commercialization of a version of the battery that utilizes monosulfide (FeS) positive electrodes in conjunction with low cost, iron alloy current collectors is indicated. Multiple-electrode cells having a specific energy of about 100 Wh/kg are now under test. Conceptual design problems for a compact insulating jacket, which will maintain the battery temperature at 450 C, appear to be solved. Work is also underway on a version of the battery that would utilize FeS2 positive electrodes, which use molybdenum current collectors at present and may require the future development of less expensive current collectors to be commercially attractive. These batteries would ultimately have about 30 to 40% higher specific energy and 50 to 75% higher specific power than the FeS-type batteries. DOE

N80-15612# California Univ., Livermore. Lawrence Livermore Lab.
LAMINATED DISK FLYWHEEL PROGRAM
Richard G. Stone 24 Oct. 1978 9 p refs Presented at the Inform. Exchange Conf., Luray, Va., 24 Oct. 1978
(Contract W-7405-eng-48)
(UCRL-81772; CONF-781046-4) Avail: NTIS HC A02/MF A01

A program to develop the technology for high energy density, fiber composite flywheels based on the laminated disk concept is described. Progress toward optimizing the flywheel energy system with respect to low volume, low weight, manufacturability, and economy is reported. Program planning areas including the manufacturing of test model flywheels and developing a hub attachment are discussed. A.W.H.

N80-15613# Institute of Gas Technology, Chicago, Ill.
PREDICTION OF CURRENT DISTRIBUTION IN A MOLTEN CARBONATE FUEL CELL
V. Sampath, J. R. Selman, and A. F. Sammells 1978 30 p refs Presented at the 2d Intern. Symp. on Molten Salts, Pittsburgh, 15-20 Oct. 1978; Sponsored by the Electrochem. Soc., Inc.
(Contract EM-78-C-03-1735)
(CONF-781063-1) Avail: NTIS HC A03/MF A01

A mathematical model was developed to predict the performance of a molten carbonate fuel cell as a function of

anode and cathode gas compositions, gas flow rates, and polarization characteristics. The effect of gas flow modes such as crossflow and coflow and the effect of higher pressures on the current distribution were studied. The predicted polarization curves agree well with the experimentally generated polarization curves. Conditions for incorporating a microscopic porous electrode model into the overall model development are briefly outlined. DOE

N80-15614# Argonne National Lab., Ill.
DEVELOPMENT OF Li-Al/FeS CELLS WITH LiCl-RICH ELECTROLYTE
F. J. Martino, L. G. Bartholme, E. C. Gay, and H. Shimotake 1978 15 p refs Presented at the Symp. on Battery Design and Optimization, Pittsburgh, 15-20 Oct. 1978
(Contract W-31-109-eng-38)
(CONF-7810135-2) Avail: NTIS HC A02/MF A01

Rechargeable lithium-aluminum/iron sulfide cells using the LiCl-KCl eutectic (44 wt % LiCl) electrolyte were developed. The utilization of these cells at high discharge rates was hindered by the formation of J phase LiK6FeS26Cl in the FeS electrodes. To overcome this problem, four engineering size cells (approximately 100 Ah theoretical capacity) were built with LiCl-rich electrolyte (54 wt % LiCl). At the 4-h rate, the utilization of these cells was improved by more than 40% over that of cells containing the eutectic electrolyte. DOE

N80-15615# Department of Energy, Washington, D. C.
ALL-UNION SCIENTIFIC AND TECHNICAL CONFERENCE ON USE OF THE EARTH'S HEAT FOR THE PRODUCTION OF ELECTRIC POWER - SUMMARY OF REPORTS
Oct. 1978 138 p refs Transl. into ENGLISH of Vsesoyuznoye Naucho-Tekhnicheskoye Soveshchaniye. Ispol'zovaniye tepla zemli dlya Proizvodstva Electroenergii (Tezisy Dokladov), USSR Ministry of Power and Electrification, 1975 186 p Conf. held at Moscow, 10-14 Dec. 1975
(CONF-751270-Summ) Avail: NTIS HC A07/MF A01

The use and effectiveness of geothermal energy for producing electric power is discussed. Topics include the operation of geothermal electric stations and power plants, systems for the extraction of heat from the Earth's crust, drilling of geological prospecting boreholes for steam, and geophysical methods for monitoring the parameters of underground heat boilers. A.W.H.

N80-15616# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
PERFORMANCE OF RESIDENTIAL SOLAR HEATING AND COOLING SYSTEM WITH FLAT-PLATE AND EVACUATED TUBULAR COLLECTORS: CSU SOLAR HOUSE 1
W. S. Duff, T. M. Conway, G. O. G. Loef, D. B. Meredith, and R. B. Pratt 1978 14 p refs Presented at the CCMS Meeting, Dusseldorf, W. Germany, 19 Apr. 1978
(Contract EY-76-S-02-2577)
(COO-2577-17; CONF-7804101-1) Avail: NTIS HC A02/MF A01

Performance data were procured on 47 days during operation of the flat plate collector and on 112 days when the house was heated or cooled by the evacuated tube collector system. It was concluded that the system comprising an evacuated tubular collector, lithium bromide absorption water chiller, and associated equipment is highly effective in providing space heating and cooling to a small building, that it can supply up to twice the space heating and several times the cooling obtainable from an equal occupied area of good quality flat plate collectors, and that a greater fraction of the the domestic hot water can be obtained by supplying its heat from main storage. A summary of monthly and annual energy use for space heating, domestic hot water heating, and space cooling is presented. DOE

N80-15617# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A PORTABLE SPECULAR REFLECTOMETER FOR FIELD MEASUREMENTS OF SOLAR MIRROR MATERIALS
J. M. Freese Oct. 1978 23 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1918) Avail: NTIS HC A02/MF A01

A portable reflectometer designed for in the field measurements of solar mirror materials was developed. This instrument is of a convenient size for use by one operator in an outdoor environment. Instrument design, operation, and calibration are discussed. It is shown that the instrument responds linearly (+ or - 0.006 transmission units) to variations of intensity of incident and reflected beams and that the readings are not affected by the presence of stray light. The mirror materials measured with the portable instrument include samples of polished aluminum, metallized plastic film and silvered glass. The reflectance values of these materials were within + or - 0.005 reflectance units of the values obtained from appropriately averaging reflectance versus wavelength data taken with a laboratory bidirectional reflectometer. DOE

N80-15618# California Univ., Berkeley. Lawrence Berkeley Lab.
AQUIFER THERMAL ENERGY STORAGE
C. F. Tsang 1978 27 p refs Presented at the Symp. on Advanced Technol. for Storing Energy, Chicago, 10 Jul. 1978
(Contract W-7405-eng-48)
(LBL-7070; CONF-780714-2) Avail: NTIS HC A03/MF A01

The concept of thermal energy storage is examined through the storage of waste hot water from power plants or from solar energy collectors in aquifers. The hydrodynamic and thermal behaviors of the storage system are analyzed and illustrated. A computer model developed to study the physical conditions and parameters and to make realistic predictions of the energy storage and retrieval efficiencies is described. A.W.H.

N80-15619# Oak Ridge National Lab., Tenn.
INTERMEDIATE REPORT ON THE PERFORMANCE OF PLATE-TYPE ICE-MAKER HEAT PUMPS Progress Report
V. D. Baxter Oct. 1978 43 p refs
(Contract W-7405-eng-26)
(ORNL/CON-23) Avail: NTIS HC A03/MF A01

Two ice maker heat pumps were tested and compared for the effect of harvesting scheme and evaporator plate loading on performance in both water chilling and ice making modes. The systems design of each heat pump is reported with two major differences, the type of harvest scheme employed and the evaporator and compressor size, examined for efficiency and relative performance. The effect of thermostatic type cyclic operation on performance of the pumps is investigated. A.W.H.

N80-15620# Oak Ridge National Lab., Tenn. Engineering Technology Div.
CHARACTERIZATION OF OPERATING CONDITIONS FOR GAS/WATER HEAT RECOVERY STEAM GENERATORS
R. L. Graves 13 Oct. 1978 21 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6622) Avail: NTIS HC A02/MF A01

The possible operating points of air/water and helium/water steam generators are parametrically presented. Calculation procedures and a sample computer program listing are provided. Multiple saturated steam conditions are shown to be attainable with the same gas inlet and exit temperatures. Design considerations of heat transfer surface area and pumping requirements are also discussed. DOE

N80-15621# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN OCEAN THERMAL ENERGY CONVERSION
Aug. 1979 53 p
(DOE/EDP-0034) Avail: NTIS HC A04/MF A01

The present status and goals of the OTEC program are described, and potential environmental, health, safety, and sociolegal-economic impacts relevant to the program are identified. A management plan is presented for conducting and coordinating environmental research in concert with the development of appropriate technology. Five major classes of environmental concerns associated with the deployment and operation of an OTEC system are discussed. They are changes in oceanic properties, chemical pollution, operation of a manned platform, legal and institutional matters, and secondary impacts associated with site selection, construction, and operation of OTEC plants. DOE

N80-15622# Oklahoma Univ., Norman.
CRITICAL SPEEDS AND NATURAL FREQUENCIES OF

RIM-TYPE COMPOSITE-MATERIAL FLYWHEELS
C. W. Bert, T. L. C. Chen, and C. A. Kocay Sep. 1978 108 p refs
(Contract EY-76-C-04-0789)
(SAND-78-7049) Avail: NTIS HC A06/MF A01

An analytical investigation conducted on a 0.56 kWh composite material flywheel energy storage system for application in hybrid automotive vehicles is reported. The investigation calculated the critical speeds and natural frequencies of a rim type flywheel which is flexibly mounted on a finite hub, which in turn, is attached to an elastic shaft. The specific modes covered include whirling, torsional, and axial modes involving band, shaft and support flexibilities and in-plane bending, combined out of plane bending/twisting, and extensional modes of the flywheel rim. The phenomena occurring during acceleration through critical speeds and the effect of creep stress relaxation on the supporting bands are examined. DOE

N80-15623# Sandia Labs., Albuquerque, N. Mex.
OVERVIEW OF FLYWHEEL ENERGY STORAGE COMPONENT DEVELOPMENT
R. O. Woods [1978] 7 p refs Presented at 1st Inform. Exchange Conf., Luray, Va. 24 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1999C; CONF-781046-8) Avail: NTIS HC A02/MF A01

Composite flywheel design, bearings, shaft seals, and general vacuum technology are reviewed. K.L.

N80-15624# Sandia Labs., Albuquerque, N. Mex.
SANDIA COMPOSITE-RIM FLYWHEEL DEVELOPMENT
E. D. Reedy, Jr. [1978] 13 p refs Presented at 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1865C; CONF-781046-3) Avail: NTIS HC A02/MF A01

A series of flywheel spin tests and the status of the rotor development program are discussed. Two designs incorporating a 20 in. OD graphite/epoxy rim were tested. Each design utilized a different method of attaching the rim to an aluminum hub with Kevlar 49/epoxy bands. Data on rotor performance, dynamics, and failure modes are presented. DOE

N80-15625# Oak Ridge National Lab., Tenn.
ANALYSIS OF POTENTIAL IMPLEMENTATION LEVELS FOR WASTE HEAT UTILIZATION IN THE NUCLEAR POWER INDUSTRY
M. Olszewski and H. R. Bigelow Oct. 1978 34 p refs
(Contract W-7405-eng-26)
(ORNL/TM-63-2) Avail: NTIS HC A03/MF A01

An assessment of land available at nuclear power stations was performed in an effort to determine the limitations land availability would impose on the implementation of reject heat utilization systems. A waste heat utilization factor was defined for all operating and planned nuclear power stations. This factor is the percentage of the station's reject heat that could be utilized on the land available for such use at the site. An estimate of the potential for implementation at fossil stations was performed. DOE

N80-15626# California Univ., Livermore. Lawrence Livermore Lab.
ENVIRONMENTAL OVERVIEW OF GEOTHERMAL DEVELOPMENT: THE GEYSERS-CALISTOGA KGRA. VOLUME 1: ISSUES AND RECOMMENDATIONS
D. L. Ermak and P. L. Phelps 4 Oct. 1978 21 p refs
(Contract W-7405-eng-48)
(UCRL-52496-Vol-1) Avail: NTIS HC A02/MF A01

Priorities of the impacts of geothermal resource development on local communities and environments are assessed and recommendations are given particularly in the hydrogen sulfide emissions from the geysers steam evolved. Other high priority needs are related to controlling noise from geothermal development, land-use conflicts between geothermal and other potential uses, impacts from landslide and soil erosion induced by geothermal development and protection of rare and endangered species in the region. DOE

N80-15627# Sandia Labs., Albuquerque, N. Mex.
PULSAR: AN INDUCTIVE PULSE POWER SOURCE
E. C. Cnare, W. P. Brooks, and M. Cowan 1979 4 p refs Presented at the Pulsed Power Conf., Lubbock, Tex., 12 Jun. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1246C; CONF-790622-19) Avail: NTIS HC A02/MF A01

The pulsar concept of inductive pulsed power source which uses a flux compressing metallic or plasma armature rather than a fast opening switch to transfer magnetic flux to a load is discussed. The inductive store is a relatively unsophisticated dc superconducting magnet. The development of much faster plasma armatures for use in larger systems of one and two meters diameter is examined. Techniques used to generate the required high magnetic Reynolds number flow are described. DOE

N80-15628# Hawaii Univ. at Manoa, Honolulu. Hawaii Natural Energy Inst.
SOLAR/WIND HANDBOOK FOR HAWAII: TECHNICAL APPLICATIONS FOR HAWAII, THE PACIFIC BASIN AND SITES WORLDWIDE WITH SIMILAR CLIMATIC CONDITIONS
W. Falicoff, G. Koide, and P. Takahashi May 1979 647 p refs Prepared jointly with Hawaii Univ., Hilo and Hawaii State Dept. of Planning and Economic Development
(Contract W-7405-eng-48)
(UCRL-15053) Avail: NTIS HC A99/MF A01

The techniques are presented for using solar energy and wind power in applications such as domestic hot water production, space cooling, process heating, and power generation. The findings and information are based upon conditions in Hawaii, but can apply to locations with similar environments such as the entire Pacific area. DOE

N80-15629# Argonne National Lab., Ill.
TURBOMACHINERY OPTIONS FOR AN UNDERGROUND PUMPED HYDROELECTRIC STORAGE PLANT
C. A. Blomquist, S. W. Tam, and A. A. Frigo 1979 11 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790803-50) Avail: NTIS HC A02/MF A01

Various turbomachinery options for underground pumped hydroelectric storage (UPHS) plants are reviewed. Current technology indicates that the maximum head for single-stage, reversible, Francis-type pump turbines is 625 m; for separate, single-stage, Francis-type turbines and multistage pumps, 672 m; for tandem units consisting of separate multijet impulse turbines and multistage pumps, 1440 m; and for multistage, reversible, ungated Francis-type pump turbines, 1290 m. Engineering design studies indicate that heads for the single-stage reversible units could be extended to 1000 m, developing 500 MW output per unit. The studies also indicate that two stage, reversible, Francis-type pump turbines with adjustable wicket gates could be developed for power outputs up to 500 MW at operating heads as high as 1500 m. DOE

N80-15630# Department of Energy, Washington, D. C. Office of Consumption Data System.
FEDERAL ENERGY DATA SYSTEM (FEDS) STATISTICAL SUMMARY UPDATE
J. P. Galliker Jul. 1979 854 p
(DOE/EIA-0192) Avail: NTIS HC A99/MF A01

The Federal energy data system statistical summary update displays state level energy consumption by major economic sectors for the years 1960 to 1977. The data are displayed in both calorific units and physical units. Fuels are divided into categories, i.e., highway gasoline in the transportation sector; kerosene in the residential sector; coking coal and petroleum coke in the industrial sector; and diesel in the transportation sector. DOE

N80-15631# Department of Energy, Washington, D. C. International Energy Analysis Div.
ENERGY DEMAND IN THE DEVELOPING COUNTRIES
J. Child and Mark Rodekohr Apr. 1979 20 p refs
(DOE/EIA-0183/10) Avail: NTIS HC A02/MF A01

An analysis of the demand for energy in developing countries

is summarized. A model of developing country energy demand which is econometric in nature and is designed to forecast demand for oil, coal, and natural gas - excluding non-fossil fuels is described. The model and data used in the analysis are defined, and results generated with the 1978 model and the 1977 model based on identical sets of assumptions are compared. DOE

N80-15632# California Univ., Livermore. Lawrence Livermore Lab.
LLL MATERIALS PROGRAM FOR FIBER-COMPOSITE FLYWHEELS
J. A. Rinde 26 Jul. 1979 13 p refs Presented at the Mech. and Mag. Energy Storage Contractor, Washington, D.C., 19 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-83043; CONF-790854-2) Avail: NTIS HC A02/MF A01

Fiber composite flywheels were studied in the areas of matrix resins, stress rupture, static engineering properties, fatigue, and time dependent engineering properties. Results are reported for physical and mechanical tests of a low cost matrix-resin system suitable for service up to 150 C. Results of stress rupture tests on E-glass are reported. Static engineering properties on a Kevlar-49/rubberized-epoxy composite are reported for tests at 25 and 75 C. Creep and fatigue tests were performed over a wide range of stress levels. Both input loads and material response strains were measured and used to correlate times to failure under creep and fatigue loading histories. DOE

N80-15633# SRI International Corp., Menlo Park, Calif.
ECONOMIC IMPACTS OF ENERGY CONSERVATION AND RENEWABLE ENERGY SOURCES
R. C. Carlson 1979 21 p refs
(Contract W-7405-eng-48)
(UCRL-15087) Avail: NTIS HC A02/MF A01

An overall theory of the economic impacts of alternative energy developments is developed. Literature on such impacts is reviewed and economic impacts of alternative energy development scenarios for California are projected. Economic impacts include changes in aggregate employment, unemployment, real income, and real output. Changes in each of these measures are analyzed in circumstances that include incentives or mandates for increased energy conservation or use of renewable energy resources. DOE

N80-15634# Brookhaven National Lab., Upton, N. Y.
MARKAL: A MULTIPERIOD LINEAR-PROGRAMMING MODEL FOR ENERGY SYSTEMS ANALYSIS (BNL VERSION)
H. Ablock, C. Bergstrom, J. Brady et al 1979 23 p refs Presented at the Energy Systems Analysis Intern. Conf., Dublin, 9 Oct. 1979
(Contract EY-76-C-02-0016)
(BNL-26390; CONF-791007-3) Avail: NTIS HC A02/MF A01

A computer program, MARKAL, a demand-driven, multiperiod, LP model of energy supplies and demands, is described. Its intended application is at the level of an entire nation. MARKAL takes exogenously supplied energy-demand figures and determines the optimal energy-supply and end-use-device network that can meet the demand. The computer systems design and requirements are discussed. The use of MARKAL for assessing the merits of energy technologies and characterizing their likely technological and economic characteristics is examined. DOE

N80-15635# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FLYWHEEL ENERGY STORAGE AND CONVERSION SYSTEM FOR PHOTOVOLTAIC APPLICATIONS
A. R. Millner 1979 15 p Presented at the Intern. Assembly on Energy Storage, Dubrovnik, Yugoslavia, 27 May 1979
(Contract EY-76-C-02-4094)
(COO-4094-48; CONF-790515-4) Avail: NTIS HC A02/MF A01

The design of a flywheel energy storage and conversion system is examined. The system serves as an interface between a solar photovoltaic array and an ac load, providing output waveform regulation as well as energy storage. Characteristics of the system include magnetic bearings, an ironless armature motor generator, and a low cost flywheel rotor. An economic analysis is presented. DOE

N80-15636# Acres American, Inc., Buffalo, N. Y.
FEASIBILITY OF COMPRESSED AIR ENERGY STORAGE AS A PEAK SHAVING TECHNIQUE IN CALIFORNIA. VOLUME 1: EXECUTIVE SUMMARY Final Report
[1979] 21 p
(Contract EY-76-C-03-1331)
(SAN-1331-T2) Avail: NTIS HC A02/MF A01

The feasibility of compressed air energy storage use based upon an analysis of the status of both underground and aboveground technology, the economic feasibility, and siting feasibility for California is studied. The power plant operation and energy use are examined and a conceptual design for a compressed air energy storage system is presented. A.W.H.

N80-15637# Sandia Labs., Albuquerque, N. Mex. Systems Analysis Div.
SOLAR MECHANICAL ENERGY STORAGE PROGRAM OVERVIEW AND SYSTEMS ANALYSIS RESULTS
B. C. Caskey 1979 6 p refs Presented at the Mechanical and Mag. Energy Storage Contractor, Washington, D.C., 19 Aug. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1642C; CONF-790854-1) Avail: NTIS HC A02/MF A01

The mechanical energy storage modes that are used in conjunction with solar inputs supplying small to intermediate loads are evaluated. Energy storage systems considered are flywheels, a pneumatic energy storage system, and low head pumped hydro storage. The development of low cost stationary flywheel technology is discussed. A computer program for systems analysis of the energy storage systems is described which uses economic parameters, system size, collector output and load demand based on hourly weather data for input data. A.W.H.

N80-15638# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DESCRIPTION OF THE MIT/LINCOLN LABORATORY PHOTOVOLTAIC SYSTEMS TEST FACILITY
S. B. Sacco 30 Jun. 1979 25 p ref
(Contract EY-76-C-02-4094)
(COO-4094-41) Avail: NTIS HC A02/MF A01

The test facility and the mechanical and electrical interfaces for items to be tested are described. These interfaces include those for the solar array, batteries, inverters, and for backup dc power sources. Permanent power and instrumentation wiring at the facility are depicted in sufficient detail to permit test plans to be drawn up from these descriptions. DOE

N80-15639# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
ROLE OF THE GOVERNMENT IN THE DEVELOPMENT OF SOLAR ENERGY
M. D. Yokell 1979 29 p refs Presented at the Ann. Meeting Assoc. for the Advan. of Sci., Houston, Tex., 4 Jan. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-52-138; CONF-790122-3) Avail: NTIS HC A03/MF A01

The economic rationale for a Federal solar energy subsidy program, the type of program required, and methods for determining the proper funding level for each program are discussed. An introduction offers a brief description of solar technologies. A summary of the current Federal solar subsidy program is also provided. DOE

N80-15640# Department of Energy, Washington, D. C. Office of Leasing Policy Development.
FEDERAL LEASING AND OUTER CONTINENTAL SHELF ENERGY PRODUCTION GOALS
Jun. 1979 426 p refs
(DOE/RA-0037) Avail: NTIS HC A19/MF A01

The growing U.S. dependence on foreign energy sources, coupled with a limited mid-term supply of newer energy sources, has focused national energy policy on expanding domestic production of fossil fuels. Considering that up to 60 percent of the nation's undiscovered energy resources may be located on the Outer Continental Shelf (OCS) and that new opportunities

exist for redirecting Federal management of OCS lands, the energy potential of the OCS was assessed. Oil and natural gas production goals for the OCS were established and are presented. The goals were determined by adding the production from existing OCS leases and estimated production from lease sales appearing on proposed lease schedules. R.E.S.

N80-15641# Sandia Labs., Albuquerque, N. Mex. System Analysis Div.
SOLAR ENHANCED OIL RECOVERY: AN ASSESSMENT OF ECONOMIC FEASIBILITY
K. D. Bergeron May 1979 51 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0787) HC A04/MF A01

An assessment of the potential economic viability of solar enhanced oil recovery (EOH) is presented. The technical and physical aspects of the merging of solar energy with EOR are examined. A cost model of the system based on a number of assumptions including operating lifetime, nonsteam costs, tax credits, and fuel prices is presented. A.W.H.

N80-15642# Electric Power Research Inst., Palo Alto, Calif. Fossil Fuel and Advanced Systems Div.
FEASIBILITY STUDY FOR ENHANCING THE DEVELOPMENT OF FUSION ENERGY
N. A. Amherd, ed. and J. H. Vanston, ed. Mar. 1979 158 p refs
(EPRI-ER-778-SR) Avail: NTIS HC A08/MF A01

Areas of work, as well as contributions to fusion program planning are presented. The feasibility of a comprehensive project addressing programmatic issues was investigated. A historical examination of the commercial development of selected large scale technologies, together with the specification of the methods for examining the compatibility of the fusion program with the electric utilities needs, and a plan for a detailed study of the safety and environmental issues of fusion power is given. Summaries of interviews with several people who have played key roles in the management of high technology development programs are reported. R.C.T.

N80-15643# Los Alamos Scientific Lab., N. Mex.
WATER USE ALTERNATIVES FOR NAVAJO ENERGY PRODUCTION
D. Abbey 1979 17 p refs Presented at the Navajo Energy and Environ. Technol. Training Conf., Tsaile, Ariz., 30 May 1979
(Contract W-7405-eng-36)
(LA-UR-79-1598; CONF-790550-3) Avail: NTIS HC A02/MF A01

The technologies and estimate costs ($/af saved) for those activities for which water conservation is feasible are described. The range of water requirements compared to energy and water resource estimates, alternative criteria for energy and water resource management are discussed: (1) promote energy activities with the lowest minimum water requirements; (2) require industry to use low quality water resources and the most effective water conservation technology; and (3) maximize the economic return on Navajo water reqources ($/af consumed). DOE

N80-15644# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: NBS/DOE WORKSHOP, STABILITY OF (THIN FILM) SOLAR CELLS AND MATERIALS
David E. Sawyer, ed. and Harry A. Schafft, ed. Aug. 1979 185 p refs Workshop held at Gaithersburg, Md., 1-3 May 1978 Sponsored in part by DOE
(PB-299964/7; NBS-SP-400-58; LC-79-600098) Avail: NTIS HC A09/MF A01 CSCL 10B

Long term stability of terrestrial solar cells using thin film materials and device technologies is discussed. Papers relating to solar cells of the following three material groupings: (1) Cu2S/(CdZn)S, Cu-ternaries/CdS, and amorphous Si; (2) polycrystalline, metal-insulator-semiconductor and conducting-oxide Si; and (3) polycrystalline, and antireflection-coated metal-oxide-semiconductor GaAs are presented. GRA

N80-15645# New Mexico Energy Inst., Las Cruces.
USE OF GEOTHERMAL ENERGY FOR DESALINATION IN NEW MEXICO: A FEASIBILITY STUDY Final Report, 7 Jan. 1977 - 30 May 1979
Lokesh Chaturvedi, Conrad G. Keyes, Jr., Chandler A. Swanberg, Yash P. Gupta, Marion Michael Hightower, and Ray Jay Davis (Arizona Univ.) Jun. 1979 142 p refs
(PB-299271/7; NMEI-42) Avail: NTIS HC A07/MF A01 CSCL 07C

The availability versus the requirements of water in the New Mexico area is examined. The use of geothermal energy for the desalinization of water in order to increase the water supply to the area is studied. Geothermal desalinization technology is reported along with potential geothermal desalinization sites. Saline and geothermal aquifer well fields design are described. Environmental, legal, and institutional considerations are outlined. A.W.H.

N80-15646# National Bureau of Standards, Washington, D.C. National Engineering Lab.
MEASUREMENT TECHNIQUES FOR SOLAR CELLS Quarterly Report, 1 Apr. - 30 Jun. 1978
D. E. Sawyer, H. K. Kessler, and H. A. Schafft Oct. 1979 30 p refs Prepared for DOE, Washington, D.C.
(PB-301309/1; NBSIR-79-1909) Avail: NTIS HC A03/MF A01 CSCL 10B

The technique of employing cell forward-biasing during scanning to reveal cell defects was implemented. Using an electrical current source, cell cracks and metallization regions disconnected from the cell output electrode were readily revealed. The mathematical analysis work supporting the experimental scanning of cells was extended to more realistic cell geometries than the one-dimensional one. Developments in scanner equipment and ancillary techniques include the completion of the high intensity insolation source for forward-biasing cells with light during scanning, an improvement in coupling biased and scanned cells to the display screen electronics, and an increase in the cell scanning area. R.E.S.

N80-15647# Syracuse Research Corp., N. Y. Energy Research Center.
PROJECT EVALUATION AND QUALITY CONTROL
Arthur Levy Jan. 1979 18 p
(Grant CSA-30200-L-76-01)
(PB-301048/5; SRC-TR-555.20) Avail: NTIS HC A02/MF A01 CSCL 13A

Quality control and evaluation of weatherization/energy programs are discussed. Among the issues presented are truck and tool maintenance, inventory control, work evaluation, and personnel evaluation and training. K.L.

N80-15648# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ENERGY PROGRAM AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Apr. - Jun. 1979
W. J. Toth, R. W. Henderson, W. F. Barron, A. C. Goodman, and C. S. Leffel, Jr. Jul. 1979 46 p refs
(PB-310245/7; APL/JHU/EQR-79-2) Avail: NTIS HC A03/MF A01 CSCL 10A

Topic areas covered include: geothermal energy development planning, hydroelectric power development, energy conversion and storage techniques, power plant site evaluation, and ocean thermal energy conversion development. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-15649*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCEEDINGS OF SHUTTLE ENVIRONMENTAL EFFECTS PROGRAM REVIEW
Andrew E. Potter, ed. Washington Jan. 1980 124 p refs Conf. held at Kennedy Space Center, Fla., 21-22 Mar. 1978

(NASA-CP-2110; S-489) Avail: NTIS HC A06/MF A01 CSCL 13B

Measurements of Titan exhaust cloud effluents are documented and compared, mesoscale and microphysical acid rain models are described, and a submesoscale model is proposed. Various instruments and facilities for measuring ice nuclei and other constituents of solid rocket motor exhaust effluents are discussed. Regional air quality monitoring and rain collection systems are described, and the ecological impact of solid rocket motor exhaust effluents is examined. The potential effect of space shuttle launches is estimated where data are adequate. For individual titles, see N80-15650 through N80-15659.

N80-15650*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CLOUD VOLUME STUDIES
R. J. Bendura *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 1-4 (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

A time history of cloud growth for the Titan 3 launch was obtained by using optical data provided by three Askania trackers (position of the cloud) and three Hasselblad cameras (cloud volume). Two quasi-independent measurements of ground cloud volume as a function of time were obtained. Aircraft time in the cloud, as measured by the rapid response nephelometer onboard the aircraft, was used for determining cloud volume. Cloud volume from aircraft measurements for the entire operation is summarized. A.W.H.

N80-15651*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IN SITU EXHAUST CLOUD MEASUREMENTS
Dewey Wornom *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 5-7 (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

Airborne in situ exhaust cloud measurements were conducted to obtain definitions of cloud particle size range, Cl2 content, and HCl partitioning. Particle size distribution data and Cl2 measurements were made during the May, August, and September 1977 Titan launches. The measurements of three basic effluents - HCl, NO sub X, and particles - against minutes after launch are plotted. The maximum observed HCl concentration to the maximum Cl2 concentration are compared and the ratios of the Cl2 to the HCl is calculated. A.W.H.

N80-15652*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MEASUREMENT OF PARTICULATES
D. Woods *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 9-12 (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

The size distributions of particles in the exhaust plumes from the Titan rockets launched in August and September 1977 were determined from in situ measurements made from a small sampling aircraft that flew through the plumes. Two different sampling instruments were employed, a quartz crystal microbalance (QCM) cascade impactor and a forward scattering spectrometer probe (FSSP). The QCM measured the nonvolatile component of the aerosols in the plume covering an aerodynamic size ranging from 0.05 to 25 micrometers diameter. The FSSP, flown outside the aircraft under the nose section, measured both the liquid droplets and the solid particles over a size range from 0.5 to 7.5 micrometers in diameter. The particles were counted and classified into 15 size intervals. The presence of a large number of liquid droplets in the exhaust clouds is discussed and data are plotted for each launch and compared. A.W.H.

N80-15653*# Naval Weapons Center, China Lake, Calif.
ICE NUCLEI MEASUREMENTS FROM SOLID ROCKET MOTOR EFFLUENTS
Edward E. Hindman, II *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 13-26 (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

The ice crystal forming nuclei (IN) measured in solid rocket motor (SRM) exhaust products is discussed in relation to space shuttle exhaust. Preliminary results from laboratory investigations and flight preparations for March 1978 Titan launch are discussed. The work necessary to provide adequate measurements of IN and cloud condensation nuclei (CCN) in the stabilized ground clouds from SRM's is studied. A.W.H.

N80-15654*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GROUND-BASED MEASUREMENTS OF DM-2 ROCKET EXHAUST EFFLUENTS USING FIXED-FLOW SAMPLERS AND ELECTRETS
Michael Susko *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 27-32 (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

Electret devices were used to collect samples of rocket exhaust products. The samples were analyzed by X-ray spectroscopy. The performance of the electrets was compared with that of Thiokol fixed flow samplers during the static test firing of a solid rocket motor (SRM) demonstration model. A vertical profile of wind speed, wind direction, and air temperature, used as inputs to the multilayer diffusion model for the SRM static test is presented. A.W.H.

N80-15655*# Michigan Univ., Ann Arbor.
ACID RAIN: MESOSCALE MODEL
Hsiao-ming Hsu *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 33-63 refs (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

A mesoscale numerical model of the Florida peninsula was formulated and applied to a dry, neutral atmosphere. The prospective use of the STAR-100 computer for the submesoscale model is discussed. The numerical model presented is tested under synoptically undisturbed conditions. Two cases, differing only in the direction of the prevailing geostrophic wind, are examined: a prevailing southwest wind and a prevailing southeast wind, both 6 m/sec at all levels initially. A.W.H.

N80-15656*# Michigan Univ., Ann Arbor.
ACID RAIN: MICROPHYSICAL MODEL
A. N. Dingle *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 65-82 refs (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

A microphysical model was used to simulate the case of a ground cloud without dilution by entrainment and without precipitation. The numerical integration techniques of the model are presented. The droplet size spectra versus time and the droplet molalities for each value of time are discussed. A.W.H.

N80-15657*# Department of Agriculture, Washington, D.C.
RESPONSE OF SELECTED PLANT AND INSECT SPECIES TO SIMULATED SRM EXHAUST MIXTURES AND TO EXHAUST COMPONENTS FROM SRM FUELS
Walter W. Heck *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 85-99 refs (For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

The possible biologic effects of exhaust products from solid rocket motor (SRM) burns associated with the space shuttle are examined. The major components of the exhaust that might have an adverse effect on vegetation, HCl and Al2O3 are studied. Dose response curves for native and cultivated plants and selected insects exposed to simulated exhaust and component chemicals from SRM exhaust are presented. A system for dispensing and monitoring component chemicals of SRM exhaust (HCl and Al2O3) and a system for exposing test plants to simulated SRM exhaust (controlled fuel burns) are described. The effects of HCl, Al2O3, and mixtures of the two on the honeybee, the corn earworm, and the common lacewing and the effects of simulated exhaust on the honeybee are discussed. A.W.H.

N80-15658*# Florida Technological Univ., Orlando.
ECOLOGICAL BASELINE STUDIES
Dave Vickers *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 101-115 (For

primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

Environmental studies of Merritt Island are discussed. Five areas of the island's ecology are examined. They include: a terrestrial community analyses, a plant community study, a small mammal population study, a rainfall study, and an ichthyological analyses. A.W.H.

N80-15659*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
AIR QUALITY MONITOR AND ACID RAIN NETWORKS
Hans Rudolph *In* NASA. Johnson Space Center Proc. of Shuttle Environ. Effects Program Rev. Jan. 1980 p 117-123
(For primary document see N80-15649 06-45)
Avail: NTIS HC A06/MF A01 CSCL 13B

The air quality monitor program which consists of two permanent air monitor stations (PAMS's) and four mobile shuttle pollutant air monitor stations (SPAMS's) is evaluated. The PAMS measures SO sub X, NO sub X particulates, CO, O3, and nonmethane hydrocarbons. The SPAMS measures O3, SO2, HCl, and particulates. The collection and analysis of data in the rain monitor program are discussed. A.W.H.

N80-15660*# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
ANALYSIS OF THE MEASURED EFFECTS OF THE PRINCIPAL EXHAUST EFFLUENTS FROM SOLID ROCKET MOTORS Final Report
R. Dawbarn, M. Kinslow, and D. J. Watson Washington NASA Jan. 1980 149 p refs
(NASA Order H-19386-B)
(NASA-CR-3136) Avail: NTIS HC A07/MF A01 CSCL 13B

The feasibility of conducting environmental chamber tests using a small rocket motor to study the physical processes which occur when the exhaust products from solid motors mix with the ambient atmosphere was investigated. Of particular interest was the interaction between hydrogen chloride, aluminum oxide, and water vapor. Several types of instruments for measuring HCl concentrations were evaluated. Under some conditions it was noted that acid aerosols were formed in the ground cloud. These droplets condensed on Al2O3 nuclei and were associated with the rocket exhaust cooling during the period of plume rise to stabilization. Outdoor firings of the solid rocket motors of a 6.4 percent scaled model of the space shuttle were monitored to study the interaction of the exhaust effluents with vegetation downwind of the test site. Data concerning aluminum oxide particles produced by solid rocket motors were evaluated. R.E.S.

N80-15661# Utah State Univ., Bedford, Mass. Electro-Dynamics Labs.
INTERPRETATION OF NO AND OH EMISSION FROM 1976 AIRBORNE MEASUREMENTS
John H. Schummers and Ronald J. Huppi 1 Jan. 1979 58 p refs Sponsored in part by DNA
(Contract F19628-78-C-0018; AF Proj. 7670)
(AD-A073898; EDL-SRL-79-1; DNA-HAES-80; AFGL-TR-79-0027; SR-1) Avail: NTIS HC A04/MF A01 CSCL 04/1

Measured infrared emission enhancements and backgrounds in the 2.83 to 3.04 micron region are analyzed. The measurements used for the analyses were collected from the AFGL NKC-135A flying laboratory during the 1976 DNA/AFGL ICECAP program. Chemiluminescence from hydroxyl fundamental chemistry was found to be the major background emitter in the measurement region, and aurorally excited, nitric oxide first overtone chemistry is believed to account for large observed enhancements. Assuming the enhancements result from NO chemistry, calculations were made to determine the percentage of the total auroral electron energy which is radiated as first overtone nitric oxide photons. The calculated percentage was found to vary from one measurement period to the next. It ranged from .4% to 1.0%, which probably indicates that the excitation is dependent on the auroral penetration depths and characteristics. GRA

N80-15662# Army Construction Engineering Research Lab., Champaign, Ill.
INTERACTIVE ENVIRONMENTAL IMPACT COMPUTER SYSTEM (EICS) USER MANUAL Final Report
Robert Baran Sep. 1979 31 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A074890; CERL-TR-N-80) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes the Environmental Impact Computer System (EICS) and provides instructions for obtaining and using output for the current interactive version of the system. It is recommended that the instructions be used to obtain the most efficient use of the system. GRA

N80-15663# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN PHOTOVOLTAICS
Sep. 1979 34 p refs
(DOE/EDP-0031) Avail: NTIS HC A03/MF A01

Potential environmental, health, safety, and socioeconomic impacts relevant to solar photovoltaic systems are identified. A management plan is then presented for conducting and coordinating environmental research in concert with the technology development effort to ensure that the identified environmental issues are resolved prior to significant public deployment of the technology. DOE

N80-15664# Argonne National Lab., Ill. Energy and Environmental Systems Div.
OTEC PHYSICAL AND CLIMATIC ENVIRONMENTAL IMPACTS
J. D. Ditmars and R. A. Paddock 1979 10 p refs Presented at OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-790631-11) Avail: NTIS HC A02/MF A01

The Department of Energy program for the development and application of analyses and models for the prediction of the physical aspects of OTEC impacts is reviewed. The effects of intake/discharge designs and of ambient ocean conditions on recirculation and near field effluent plume behavior were investigated by means of physical models. Further study of the intake flow fields may be necessary to make estimates of intake impingement and entrainment effects. Mathematical analysis of intermediate field mixing of plant effluents showed that effluent plumes may have vertical dimensions on the order of meters and lateral dimensions on the order of kilometers. Basin-wide resource renewal and physical environmental effects are being studied by means of a numerical model of the Gulf of Mexico with detailed vertical resolution. Concerns regarding climatic impacts presently are focused on atmospheric CO2 loading and modification of air-sea heat exchange processes due to OTEC operation. DOE

N80-15665# San Jose State Univ., Calif. Dept. of Meteorology
SURVEY OF STATISTICAL TECHNIQUES USED IN VALIDATION STUDIES OF AIR POLLUTION PREDICTION MODELS
R. D. Bornstein Mar. 1979 48 p refs
(Contract EY-76-S-02-2874)
(COO-2874-50) Avail: NTIS HC A03/MF A01

Graphical, tabular, and summary techniques used to validate predictions made by air pollution models are surveyed. Some of the practical problems associated with verification are also discussed. Characteristics desired in any validation program are listed and a suggested combination of techniques that possess many of these characteristics is presented. GRA

N80-15666# California Univ., Livermore. Lawrence Livermore Lab.
MAN'S EFFECT ON STRATOSPHERIC OZONE
H. W. Ellsaesser Aug. 1979 23 p refs Presented at the 4th Intern. Symp. on Environmental Biogeochemistry, Canberra, Australia, 26-31 Aug. 1979 Sponsored in part by FAA
(Contract W-7405-eng-48)
(UCRL-82556) Avail: NTIS HC A02/MF A01

The modification of the stratospheric ozone uv shield by man-induced mechanisms is discussed. The mechanisms reviewed include: (1) the atmospheric release of stable Br compounds such as the soil fumigant CH3Br; (2) the release of chlorocarbons; (3) the release of IR absorbing gases such as CO2; and (4) the

release of nitrogen oxides through the detonation of nuclear devices, the use of fertilizers, and combustion. K.L.

N80-15667# Department of Energy, Bartlesville, Okla. Energy Technology Center.
EMISSIONS CHARACTERISTICS OF SIX HIGH-SPEED DIESEL ENGINES
W. F. Marshall Oct. 1978 14 p refs
(BETC/TPR-78/7) Avail: NTIS HC A02/MF A01

Emissions characteristics of six high speed diesel engines were determined in order to assess the potential for use of this type of engine in underground mines. Emissions of nitrogen oxide were low; carbon monoxide and smoke levels were reduced to acceptable levels by limiting the maximum power capability of the engines. The relatively high power densities of these engines, along with these emissions characteristics, indicate good potential for their use in underground mines. DOE

N80-15668# California Univ., Livermore. Lawrence Livermore Lab.
IDENTIFICATION OF ENVIRONMENTAL CONTROL TECHNOLOGIES FOR GEOTHERMAL DEVELOPMENT IN THE IMPERIAL VALLEY OF CALIFORNIA
D. F. Snoeberger and J. H. Hill 5 Oct. 1978 33 p refs
(Contract W-7405-eng-48)
(UCRL-52548) Avail: NTIS HC A03/MF A01

Control technologies to manage environmental impacts from geothermal developments in California's Imperial Valley are discussed. Included are descriptions of methods for managing land subsidence by fluid injection; for preventing undesirable induced seismicity or mitigating the effects of seismic events; for managing liquid wastes through pretreament or subsurface injection; for controlling H2S by dispersal, reinjection, and chemical treatment of effluents; and for minimizing the impact of noise from power plants by setting up buffer zones and exclusion areas. DOE

N80-15669# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: ELECTRIC ENERGY SYSTEMS
Aug. 1979 58 p refs
(DOE/EDP-0038) Avail: NTIS HC A04/MF A01

The Electric Energy Systems (EES) program is discussed. The program includes the following projects: electric field effects, underground transmission, high-voltage dc technology, advanced transformer and generator concepts, compact stations, and dispersed storage and generation. The projects were examined to identify their environmental impact and the resulting concerns. Management plans for meeting the environmental requirements are identified, along with the organizations responsible for managing the environmental research associated with the EES program. DOE

N80-15670# Oak Ridge Associated Universities, Tenn.
DEVELOPMENT OF THE ROCKY MOUNTAIN ENERGY AND ENVIRONMENTAL TECHNOLOGY CENTER: A PRELIMINARY ANALYSIS
T. McKinley, J. Doggett, and J. Little Jun. 1979 34 p
(Contract EY-76-C-05-0033)
(ORAU-158) Avail: NTIS HC A03/MF A01

The events that contributed to the evolution of RME and ETC are emphasized. All of the organizations which have aided the development of RME and ETC are identified. The private and shared agendas of each are explored. A historical synopsis is presented to provide a chronological time frame for program development. Training programs in machining, word processing, and chemical operating are described. Characteristics of the total 79 trainees enrolled are presented; terminations and placements to date are cited. RME and ETC represents one coordinated approach to industry-based CETA skills training. The key elements that contributed to the current RME and ETC are identified. Recommendations are offered for present and future program implementation. DOE

N80-15671# National Technical Information Service, Springfield, Va.
MANEUVERING AIRCRAFT: NOISE POLLUTION AND CONTROL, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Aug. 1979
Guy E. Habercom, Jr. Sep. 1979 167 p Supersedes NTIS/PS-78/0930; NTIS/PS-77/0786; NTIS/PS-76/0733; NTIS/PS-75/ 762; NTIS/PS-75/060
(NTIS/PS-79/0973/2; NTIS/PS-78/0930; NTIS/PS-77/0786; NTIS/PS-76/0733; NTIS/PS-75/762; NTIS/PS-75/060) Avail: NTIS HC $28.00/MF $28.00 CSCL 20A

Methods for alleviating noise created by maneuvering aircraft are cited. Flyby, turning flight, takeoffs, and landings are the maneuvers investigated. (The updated bibliography contains 159 abstracts, 18 of which are new entires to the previous edition.) GRA

N80-15672# Air Pollution Technology, Inc., San Diego, Calif.
EVALUATION OF GRANULAR BED FILTERS FOR HIGH-TEMPERATURE/HIGH-PRESSURE PARTICULATE CONTROL
Shui-Chow Yung, Ronald Patterson, Richard Parker, and Seymour Calvert Jan. 1979 242 p refs
(Contract EPA-68-02-2183)
(PB-299195/8; EPA-600/7-79-020) Avail: NTIS HC A11/MF A01 CSCL 13K

The status and potential of granular bed filter (GBF) technology for fine particulate control was critically reviewed and evaluated with emphasis on high temperature and pressure (HTP) applications. Available theoretical models and experimental data were evaluated and found to be inadequate for predicting the performance of industrial GBF systems. Additional experimental data were obtained with a bench scale GBF. These data were used as the basis for a clean bed performance model based on inertial impaction as the primary collection mechanism. Predictions were in good agreement with data from industrial GBF systems. GRA

N80-15673# Research Triangle Inst., Research Triangle Park, N. C.
CAPTIVE AIR BAG DESIGN STUDY Final Report
R. S. Wright and J. E. Sickles, II Apr. 1979 92 p refs
Sponsored by Houston Chamber of Commerce
(PB-299636/1; RTI/1623/00-07F; HAOS-16) Avail: NTIS HC A05/MF A01 CSCL 13B

The design and field testing of a suitable large captive air bag is presented. A photochemical reactor designed for use in captive air experiments, to construct a full-scale demonstration prototype of the reactor, and to evaluate the physical and pneumatic integrity of this prototype under conditions which realistically simulate captive air experiments is described. GRA

N80-15674# Research Triangle Inst., Research Triangle Park, N. C.
HOUSTON AREA OXIDANT STUDY DETAILED HYDROCARBON ANALYSES Final Report
R. B. Denyszyn, E. Pellizzari, J. M. Harden, and D. L. Hardison Apr. 1979 283 p refs
(PB-299629/6; RTI/1456/00-01F; HAOS-18) Avail: NTIS HC A13/MF A01 CSCL 13B

The volatile organic species present in the Houston ambient air were identified. Several gas chromatographic techniques were used to perform analyses for organic species on the samples collected. The samples collected were analyzed for 49 organic species ranging from C1 to C10 molecules. R.C.T.

N80-15675# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
ANALYTICAL DIFFUSION MODEL FOR LONG DISTANCE TRANSPORT OF AIR POLLUTANTS Final Report
James A. Fay and Jacob J. Rosenzweig Jun. 1979 31 p refs
(Grant EPA-R-804891)
(PB-299358/2; EPA-600/4-79-037) Avail: NTIS HC A03/MF A01 CSCL 13B

A steady-state two dimensional diffusion model suitable for predicting ambient air pollutant concentrations averaged over a long time period (e.g., month, season, or year) and resulting from the transport of pollutants for distances greater than about 100 km from the source is described. Analytical solutions are derived for the primary pollutant emitted from a point source and for secondary pollutant formed from it. The analytical theory

for the dispersion of a primary pollutant is compared with the numerical predictions of a plume trajectory model and the theory for the dispersion of a secondary pollutant is compared with measurements of the annual average sulfate concentration in the U.S. GRA

N80-15676# Hittman Associates, Inc., Columbia, Md.
ENVIRONMENTAL ASSESSMENT REPORT: SOLVENT REFINED COAL (SRC) SYSTEMS Final Report, May 1978 - May 1979
K. J. Shields, H. T. Hopkins, E. E. Weir, and Carolyn Thompson Jun. 1979 847 p
(Contract EPA-68-02-2162)
(PB-300383/7; EPA-600/7-79-146) Avail: NTIS HC A99/MF A01 CSCL 13B

Air emissions, water effluents, solid wastes, toxic substances, control/disposal alternatives, environmental regulatory requirements, and environmental effects associated with solvent refined coal (SRC) systems are evaluated. The SRC-I(solid product) and SRC-II(liquid product) variations of solvent refining are considered in terms of a hypothetical facility to produce 7950 cum/day liquefied coal products. Control and disposal options are surveyed to determine their applicability to subject discharges. Potentially applicable regulatory requirements are reviewed and compared to estimated after-treatment discharge levels. Analyses indicate that solid wastes produced by SRC systems are the greatest source of current environmental concern. GRA

N80-15677# Geological Survey, Bay Saint Louis, Miss. Gulf Coast Hydroscience Center.
ONE-DIMENSIONAL STEADY-STATE STREAM WATER-QUALITY MODEL Final Water-Resources Investigations
Daniel B. Bauer, Marshall E. Jennings, and Jeffrey E. Miller Mar. 1979 218 p refs
(PB-300327/4; USGS/WRD/WRI-79/035; USGS/WRI-79/45) Avail: NTIS HC A10/MF A01 CSCL 13B

A computer program, based on a one dimensional mathematical model which predicts the stream water quality response characteristics from waste source inputs, is described and documented. Variables predicted include dissolved oxygen, biochemical oxygen demand, nitrogen forms, total and fecal-coliform bacteria, orthophosphate-phosphorus, and various conservative substances. The model formulation is based on a steady-state assumption which requires constant flow rate of waste and stream discharges and associated parameters. To achieve a problem solution, each reach of a stream system is broken into a given number of subreaches, generally defined by locations of waste or tributary inflow points. GRA 8

N80-15678# Monsanto Co., Alvin, Tex.
THE BERYLLIUM-7 PROGRAM OF THE HOUSTON AREA OXIDANTS STUDY Final Report
Harry M. Walker Jul. 1979 83 p refs Sponsored by Houston Chamber of Commerce, Tex.
(PB-299632/0; HAOS-30) Avail: NTIS HC A05/MF A01 CSCL 13B

Levels of beryllium-7 in the ambient air of Houston, Texas were measured during 1977. Beryllium-7 is taken to be a valid parameter measuring the presence of stratospheric air and consequently the presence of stratospheric ozone during the study period. Some conclusions are reached regarding the possible role stratospheric air plays in the initiation of photochemical ozone episodes. GRA

N80-15679# Rice Center for Community Design and Research, Houston, Tex.
SOCIO-ECONOMIC IMPACT ANALYSIS OF SELECTED AIR POLLUTION CONTROLS IN THE HOUSTON-GALVESTON REGION Final Technical Report
Mar. 1979 148 p refs Sponsored by the Houston Chamber of Commerce, Tex.
(PB-299635/3; HAOS-23) Avail: NTIS HC A07/MF A01 CSCL 13B

The results of a study to develop a methodology appropriate for identifying and assessing the social and economic impacts of air pollution control programs and apply the methodology to the Houston region in order to assess the likely effects of control programs on air quality and the social and economic costs, or benefits, that would accrue to the region are presented. The scope of the study was limited to a geographic area of eight counties in and around the Houston metropolitan area. They are Harris County, Brazoria County, Fort Bend County, Chambers County, Galveston County, Liberty County, Montgomery County, and Waller County. GRA

N80-15680# Physical Dynamics Northwest, Bellevue, Wash.
AN ANALYSIS OF ATMOSPHERIC VISIBILITY DATA IN THE HOUSTON AREA Final Report
John M. Lansinger and Deborah A. Miller May 1979 115 p refs Sponsored by Houston Chamber of Commerce, Tex.
(PB-299633/8; PD/NW-78/186R; HAOS-31) Avail: NTIS HC A06/MF A01 CSCL 13B

The analysis of data related to atmospheric visbility, obtained during the Houston Area Oxidant Study (HAOS), and the measurements of visibility and visual range are described. Three methods of measuring visibility or visual range were employed during the HAOS project: human observations and instrumental measurements using a telephotometer and nephelometers. The combined measurements provided not only a means of confirming the results but also comparison of the techniques. GRA

N80-15681# Mathtech, Inc., Princeton, N. J.
EVALUATION OF THE ENVIRONMENTAL EFFECTS OF WESTERN SURFACE COAL MINING, VOLUME 1 Final Report, Jun. 1975 - Jun. 1977
Frank Cook May 1979 154 p refs
(Contract EPA-68-03-2226)
(PB-300375/3; EPA-600/7-79-110-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 13B

The methods presently used for surface mining of coal in the western United States are described and evaluated. The effects that use of those methods have on the environment are described and ways in which the methods might be altered to reduce both long term and short term environmental damage are presented. GRA

N80-15682# PEDCo-Environmental, Inc., Cincinnati, Ohio.
EPA UTILITY FGD (FLUE GAS DESULFURIZATION) SURVEY: DECEMBER 1978 - JANUARY 1979
M. Smith, M. Melia, T. Koger, R. McKibben, and J. Uihlein May 1979 453 p refs
(Contract EPA-68-02-2603)
(PB-299399/6; EPA-600/7-79-022C) Avail: NTIS HC A20/MF A01 CSCL 10B

The scope of design data for operating flue gas desulfurization (FGD) systems is expanded, section formats are revised, and a new section includes operational particulate scrubbers. Information contributed by the utility industry process suppliers, regulatory agencies, and consulting engineering firms is summarized. Systems are tabulated alphabetically by development status (operational, under construction, or in planning stages), utility company, process supplier, process, waste disposal practice, and regulatory class. Data on system design, fuel sulfur content, operating history, and actual performance are presented as well as unit by unit dependability parameters. Problems and solutions associated with the boilers and FGD systems are considered. Process flow diagrams and FGD system economic data are appended. Current data show 46 operating FGD systems, 45 systems under construction, and 67 planned units. Projected 1988 FGD capacity is about 70,000 MW. GRA

N80-15683# Environmental Research Lab., Gulf Breeze, Fla.
AMERICAN-SOVIET SYMPOSIUM ON CHEMICAL POLLUTION OF THE MARINE ENVIRONMENT, 1ST Final Report
Karl K. Turekian and Anatoliy I. Simonov Dec. 1978 209 p refs Symp. held at Odessa, USSR, 24-28 May 1977
(PB-298343/5; EPA-600/9-78-038) Avail: NTIS HC A10/MF A01 CSCL 07D

The impact of chemical pollution on the world's oceans is assessed. The fate of heavy metals in estuaries and the Gulf of Mexico, transport of natural radionuclides in shelf waters of the eastern U.S. and the distribution and dynamics of trace metals in pore water and sediment are among the topics covered. Biogeochemical research on metals in the world's oceans, monitoring chemical pollution and forecasting its biological consequences; arsenic, antimony, and mercury in seawater, and

oil and oil products in surface waters of the Atlantic, Pacific, and Indian Oceans are included. Methods of sampling water from the ocean surface microlayer and the technical composition of the microlayer, a method for determining mercury, scientific aspects of marine pollution problems, and the management of the quality of the marine environment are covered. GRA

N80-15684# Battelle Columbus Labs., Ohio.
CHEMICAL ASPECTS OF AFTERBURNER SYSTEMS Final Report, Mar. 1977 - Mar. 1979
R. H. Barnes, M. J. Sexton, R. E. Barrett, and A. Levy Apr. 1979 121 p
(Contract EPA-68-02-2629)
(PB-298465/6; EPA-600/7-79-096) Avail: NTIS HC A06/MF A01 CSCL 07D

The chemistry and reaction kinetics of oxidation and pyrolysis reaction that occur in afterburners (or fume incinerators) that are used to destroy organic pollutants in air or gas streams are reviewed. Chemical kinetic rate data are compiled for both complex and global reaction mechanisms of interest for the design and analysis of afterburner systems. Direct-flame, thermal, and catalytic afterburner systems are covered. Details are also given on techniques for estimating chemical rate data when experimental data are unavailable. Appropriate equations are given for calculating the chemical performance characteristics of afterburner systems, and recommendations are made for using chemical rate data for the analysis of afterburner systems. GRA

N80-15685# Environmental Monitoring and Support Lab., Las Vegas, Nev.
WESTERN ENERGY SULFATE/NITRATE MONITORING NETWORK Progress Report, Jan. 1975 - Jun. 1978
Michael J. Pearson, Marc Pitchford, and Robert Snelling Mar. 1979 50 p refs
(PB-299238/6; EPA-600/7-79-074) Avail: NTIS HC A03/MF A01 CSCL 13B

Little sulfate-nitrate data are available to establish a baseline and evaluate the impact of coal utilization. The number of locations monitoring sulfate and nitrate in the Western Energy Resource Development Area was increased by augmenting the existing particulate sampling networks. To evaluate and improve the quality of data obtained, a quality assurance program was established. The data reported thus far indicate generally low values in this area. Typically, sulfate values are less than 6 micrograms per cubic meter (microgram/cu m) and nitrate values are less than 3 microgram/cu m. GRA

N80-15686# Industrial Environmental Research Lab., Research Triangle Park, N. C. Particulate Technology Branch.
IN-STACK PLUME OPACITY FROM ELECTROSTATIC PRECIPITATOR/SCRUBBER SYSTEM AT HARRINGTON UNIT 1
Leslie E. Sparks May 1979 33 p refs
(PB-299215/4; EPA-600/7-79-118) Avail: NTIS HC A03/MF A01 CSCL 13B

Results are given of theoretical modeling of particulate emission and in-stack plume opacity for the electrostatic precipitator (ESP)/scrubber system at Southwestern Public Service Company's Harrington Unit 1. It was shown that 20% opacity can be achieved (1) by increasing specific collector area of the ESP and leaving the scrubber pressure drop alone, (2) by increasing scrubber pressure drop and leaving the ESP alone, (3) by replacing the existing marble bed scrubber with a venturi scrubber, increasing the pressure drop by 20%, and leaving the ESP alone, or (4) by doubling the SCA of the ESP and removing the scrubber. GRA

N80-15687# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
PILOT SCALE EVALUATION OF NOx COMBUSTION CONTROL FOR PULVERIZED COAL. PHASE 2 Final Report, Jun. 1973 - Jan. 1978
R. A. Brown, J. T. Kelly, and Peter Neubauer Jun. 1979 321 p
(Contract EPA-68-02-1885)
(PB-299325/1; EPA-600/7-79-132; Rept-78/293) Avail: NTIS HC A14/MF A01 CSCL 13B

Advanced NOx control techniques were investigated on a pilot scale test facility firing pulverized coal. Baseline and control technology tests were performed on three coal types over a range of parameters. First and second stage parameters investigated include stoichiometry, excess air, temperature, mixing residence time, and coal composition. A minimum NO level was achieved at a stoichiometric ratio between 0.75 and 0.85, depending on fuel and furnace configuration, and the longer first-stage residence times gave lower stack NO levels. To obtain NO levels below 150 ppm, first-stage residence times of up to 3 seconds were required. Second-stage parameters were found to be of second-order importance. GRA

N80-15688# Clemson Univ., S.C. Dept. of Mechanical Engineering.
ENERGY CONSERVATION THROUGH POINT SOURCE RECYCLE WITH HIGH TEMPERATURE HYPERFILTRATION Final Report, Jul. 1975 - Dec. 1978
J. L. Gaddis, C. A. Brandon, and J. J. Porter Jun. 1979 187 p refs
(Grant EPA-R-803875)
(PB-299183/4; EPA-600/7-79-131) Avail: NTIS HC A09/MF A01 CSCL 13B

The reuse of water, energy, and chemicals in the textile industry can be best achieved if separations are applied to individual point-source streams rather than to total-plant mixed effluents. Five wet processes comprise a large fraction of total textile operations and require over half of the total energy used. Each process effluent was sampled and analyzed to determine which membrane, hyperfiltration or ultrafiltration, should be used. Two small equipment skids allowed membrane operation at the plant sites. The permeable water in each case was reusable. Estimates of energy recoverable per mass of cloth processed (kJ/kg) for each operation are: rope preparation, 2646; open-width preparation, 5766; continuous dyeing, 2449; atmospheric beck dyeing, 20115; high-pressure dyeing, 3910; and low-pressure beck dyeing, 1964. GRA

N80-15689# Radian Corp., Austin, Tex.
FIELD AND LABORATORY STUDIES FOR THE DEVELOPMENT OF EFFLUENT STANDARDS FOR THE STEAM ELECTRIC POWER INDUSTRY Final Report, Jul. 1977 - Apr. 1978
Frank G. Mesich and Milton L. Owen Nov. 1978 201 p refs
(Contract EPA-68-02-2608)
(PB-299097/6; EPA-600/7-78-209) Avail: NTIS HC A10/MF A01 CSCL 13B

Results of an evaluation of carbon absorption chemical precipitation, reverse osmosis and vapor compression distillation (VCD) as removal technologies for priority pollutants from wastewater streams of utility power plants are given. Samples of plant make-up water cooling tower blowdown, ash pond effluent, and effluent waters from the treatment technologies were analyzed for priority organic and inorganic pollutants. Carbon absorption and reverse osmosis removed priority pollutants, but low concentrations prevented definitive conclusions on their removal effectiveness. Chemical precipitation, reverse osmosis, and VCD effectively reduced low concentration inorganic compounds, including arsenic, copper, and lead, all of which were present in significant concentrations in at least one wastewater stream. GRA

N80-15690# Geological Survey, Bay Saint Louis, Miss. Gulf Coast Hydroscience Center.
ESTIMATING THE GAS AND DYE QUANTITIES FOR MODIFIED TRACER TECHNIQUE MEASUREMENT OF STREAM REAERATION COEFFICIENTS Final Report
R. E. Rathbun Feb. 1979 53 p refs
(PB-299015/8; USGS/WRD/WRI-79/029; USGS/WRI-79/27) Avail: NTIS HC A04/MF A01 CSCL 13B

Stream reaeration coefficients were measured with a modified tracer technique by injecting ethylene or ethylene and propane together and a rhodamine-WT dye into the stream. The movement of the tracers through the stream reach is described by a one-dimensional diffusion equation. Equations estimating the gas flow rates, the quantities of gases, the dye concentration, and the quantity of dye together with procedures for determining the variables in these equations are presented. GRA

N80-15891# Dravo Corp., Pittsburgh, Pa.
MANAGEMENT OF COAL PREPARATION FINE WASTES WITHOUT DISPOSAL PONDS Final Report, Jul. 1977 - Jun. 1978
D. C. Hoffman, R. W. Briggs, and S. R. Michalski Jan. 1979 63 p refs
(Contract DI-G-ET-79-11270)
(PB-299100/8; EPA-600/7-79-007; FE-11270-1) Avail: NTIS HC A04/MF A01 CSCL 13B

The physical/chemical properties of a diverse sampling of fine coal refuse were investigated along with the effect of chemical stabilization. It was shown that chemical stability can be employed to drastically improve some physical/chemical properties of the fine refuse for better handling and disposal. The proprietary chemical, Calcilox (Trademark) additive, is the most effective over the range of samples tested. Portland Type 1 cement is also effective but greatly influenced by waste solids concentration. The final chemical tested, lime, is inferior to the other two chemicals and generally ineffective in improving the fine waste's physical/chemical properties. GRA

N80-15892# Engineering-Science, Inc., McLean, Va.
INVENTORY OF RESOURCES WITH EMISSIONS GREATER THAN 100 TONS/YEAR SUBJECT TO ORGANIC MATERIAL REGULATIONS IN METROPOLITAN BOSTON AQCR
John R. Busik and Peter Hagerty Jul. 1979 62 p refs
(Contract EPA-68-01-4146)
(PB-298879/8; EPA-901/1-79-008) Avail: NTIS HC A04/MF A01 CSCL 13B

An inventory of volatile organic pollutant point sources is presented. The methodologies utilized in identifying and surveying potential sources are outlined. An analysis of how the emissions levels were estimated is given. GRA

N80-15893# Battelle Columbus Labs., Ohio.
THE COST OF CLEAN AIR AND WATER REPORT TO CONGRESS
Aug. 1979 339 p refs
(Contract EPA-68-01-4360)
(PB-300446/2; EPA-230/3-79-001) Avail: NTIS HC A15/MF A01 CSCL 05C

The cost of compliance with the Clean Air and the Federal Water Pollution Control Act is discussed. In 1977 it was estimated that industries spent 12.8 billion dollars in incremental annual costs (including capital charges and operating and maintenance expenses) to comply with Federal air and water legislation. Federal, State and local governments spent $4.6 billion and consumers spent $5.8 billion directly on mobile source emission control. Projected future incremental investment costs for the period 1977-1986 will be $79.7 billion as a result of the Clean Air Act and $61.6 billion due to the Federal Water Pollution Control Act. GRA

N80-15894# Connecticut Univ., Storrs. Inst. of Water Resources.
USE OF INDICATOR SPECIES OF ALGAE TO DETERMINE WATER QUALITY
F. R. Trainor and P. A. Siver Sep. 1979 29 p refs
(Contract DI-14-34-0001-7146)
(PB-299953/0; W79-09674; OWRT-B-011-CONN(1)) Avail: NTIS HC A03/MF A01 CSCL 06F

Scenedesmus strain 170 formed unicells in response to nitrogen, primarily as ammonium. The response was due to large uptake pulses of nitrogen. Source of nitrogen, cell pretreatment, nutrition, light intensity and temperature all affected nitrogen uptake, and the resulting unicell percentages. Triggering of the unicellular stage is a complex process involving a variety of factors. The sensitivity of the morphological response, i.e., control of the unicellular stage, to many factors in addition to nitrogen made use of Scenedesmus 170 questionable for an assay for nitrogen. A second Scenedesmus, AP 1, was studied in the laboratory and field. Colonies formed in older Bristols cultures, or in densely populated young cultures. GRA

N80-15895# California Inst. of Tech., Pasadena. Dept. of Chemical Engineering.
PHOTOCHEMICAL AEROSOL DYNAMICS Final Report, Apr. 1973 - Mar. 1978
S. K. Friedlander May 1979 47 p refs
(Grant EPA-R-802160)
(PB-299212/1; EPA-600/3-79-052) Avail: NTIS HC A03/MF A01 CSCL 04A

New data are reported on (1) the rate of formation of condensable chemical species by photochemical reactions, (2) the effect of the reaction products on the particle size distribution and (3) the distribution of reaction products as a function of particle size. Gas-to-particle conversion for cyclopentene, cyclohexene and 1,7-octadiene, ranged from 5 to 39 percent of the initial gas-phase carbon concentrations. Size distribution data for cyclohexene were correlated by a diffusion controlled growth law with Kelvin cutoff diameter at about 0.25 micrometer. In polluted atmospheres, some new particle formation takes place as a result of homogeneous gas phase reactions even though an aerosol is already present. GRA

N80-15896# Abcor, Inc., Wilmington, Mass. Walden Div.
STATISTICAL ANALYSIS OF THE SOURCE-RECEPTOR RELATIONSHIPS FOR OZONE AND HAZE IN THE HOUSTON AREA Final Report
Peter H. Guldberg and Harvey E. Jeffries 25 May 1979 202 p refs
(PB-299634/6; HAOS-24) Avail: NTIS HC A10/MF A01 CSCL 04A

A combination of theoretical description cause-and-effect relationships and a statistical analysis of field data was used to synthesize a cause-and-effect model of photochemical ozone and haze formation in the Houston area. The model, its results, and conclusions are presented. Recommendations are made on further work to quantify model error bounds and to expand the data base. GRA

N80-15897# Southwest Research Inst., San Antonio, Tex.
AIRBORNE AEROALLERGEN MEASUREMENTS IN HOUSTON, TEXAS Final Report
J. T. Ivy Mar. 1979 115 p refs
(SRI Proj. 01-4901)
(PB-299643/7; HAOS-19) Avail: NTIS HC A06/MF A01 CSCL 13B

Houston air was sampled for aeroallergens on a daily schedule for a period of four months to identify major aeroallergens which might contribute to allergic responses in humans. Daily variations and seasonal trends of aeroallergens were observed which were comparable with expectations for the Houston area. For application to analysis of allergic response, aeroallergens present in the Houston area may be categorized in three major groups: ragweed pollen (Ambrosia), grass pollens (Gramineae), and total mold spores. GRA

N80-15898# Geological Survey, Lakewood, Colo. Water Resources Div.
QUANTITY AND QUALITY OF URBAN RUNOFF FROM THREE LOCALITIES IN THE DENVER METROPOLITAN AREA, COLORADO Final Report
Sherman R. Ellis and William M. Alley May 1979 69 p refs
Sponsored by Denver Board of Water Commissioners, Colo.; Denver Regional Council of Governments, Colo.; Urban Drainage and Flood Control District, Denver Colo.
(PB-299859/9; USGS/WRD/WRI-79/046; USGS/WRI-79/64) Avail: NTIS HC A04/MF A01 CSCL 13B

Considerable variation in constituent concentrations was shown in urban runoff data for 1975-77 from three metropolitan Denver drainage basins. Constituent concentrations, greatest during initial rainfall runoff, generally peaked midday of snowmelt runoff, corresponding with maximum melting and runoff. Days since last street sweeping or antecedent precipitation had no apparent effect; snowmelt-runoff loads apparently increased with number of days snow had been on the ground. Urban storm runoff may significantly contribute total ammonia nitrogen, total nonfiltrable residue, total copper, total iron, total lead, and total zinc; and snowmelt runoff may significantly contribute sodium and chloride, to local receiving waters. GRA

N80-15899# Environmental Protection Agency, Ann Arbor, Mich. Technology Assessment and Evaluation Branch.
INVESTIGATION OF THE EFFECTS OF THE INSTALLATION OF AN OXIDATION CATALYST ON A DIESEL POWERED VEHICLE

Edward Anthony Barth Mar. 1979 20 p
(PB-299928/2; TAEB-79-7) Avail: NTIS HC A02/MF A01 CSCL 13B

The use of an oxidation catalyst in diesel powered vehicles was investigated for it's effects on gaseous and particulate emissions, fuel economy, and vehicle performance. K.L.

N80-15700# Environmental Protection Agency, Washington, D.C. Div. of Stationary Source Enforcement.
COMPLIANCE STATUS OF MAJOR AIR POLLUTION FACILITIES Final Report
Jun. 1979 767 p
(PB-299959/7; EPA-340/1-79-007) Avail: NTIS HC A99/MF A01 CSCL 13B

The probable compliance status and related facility information for major stationary sources of air pollution are presented. The U.S. Environmental Protection Agency's Compliance Data System generated a report of those facilities of interest to the States or the Agency for further investigation. GRA

N80-15701# Battelle Columbus Labs., Ohio.
EVALUATION OF STATIONARY SOURCE PARTICULATE MEASUREMENT METHODS. VOLUME 5: SECONDARY LEAD SMELTERS Interim Report, Oct. 1973 - Jun. 1977
J. E. Howes, Jr., R. N. Pesut, and W. M. Henry Jun. 1979 42 p refs
(Contract EPA-68-02-0609)
(PB-300337/3; EPA-600/2-79-116) Avail: NTIS HC A03/MF A01 CSCL 13B

As part of an overall program to evaluate the EPA Method 5 procedure for measurement of particulate emissions, an experimental study was made of its specific applicability to secondary lead plant emissions. The study was carried out with two Method 5 sampling train systems operated simultaneously at a single point in the stack emission stream. A series of six statistically designed tests was conducted over a 5 day period to obtain data on the reliability of Method 5, the sensitivity of the method to variation of such key parameters as sampling system temperature, filter media, and particulate loading and to characterize the chemical composition of the emissions. GRA

N80-15702# PEDCo-Environmental, Inc., Kansas City, Mo.
EVALUATION OF PARTICULATE EMISSION FACTORS FOR VEHICLE TIRE WEAR Final Report
Joseph Corvitti Jun. 1979 30 p refs
(Contract EPA-68-02-2585)
(PB-300443/9; EPA-450/4-79-011) Avail: NTIS HC A03/MF A01 CSCL 13B

Particles from tire wear were identified by microscopic analysis as a significant component of samples taken from roadside high volume particulate samplers. The currently available emission estimate for tire wear, presented in Compilation of Air Pollutant Emission Factors (AP-42), is 0.20 g/veh-mi for a four-wheeled light duty vehicle. This emission factor is widely used in regional particulate analyses to estimate emissions from tire wear; however, this factor needs to be reviewed, based on studies and test data released since its publication. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-15703*# Florida Univ., Gainesville.
INFLUENCE OF CLOUDS ON UV-B PENETRATION TO THE EARTH'S SURFACE Final Report, 1 Sep. 1976 - 30 Sep. 1979
A. E. S. Green Sep. 1979 105 p refs
(Contract NAS9-15114)
(NASA-CR-160428) Avail: NTIS HC A06/MF A01 CSCL 04B

Radiometric measurements of cloud influence on ultraviolet B radiation (UV-B) were obtained. Mathematical models of the influence were defined to lay the groundwork for the construction of the global UV-B climatology from satellite determined ozone data. More refined measurements comparing UV-B radiation with total solar radiation were carried out. The cloudy case is referred to the cloudless sky irradiance and convenient transmission ratios are given. An approach to the inversion of scattering data is summarized. An improved characterization of the UV-B radiation from a cloudless sky is also presented. R.C.T.

N80-15704*# National Aeronautics and Space Administration, Washington, D. C.
THE REACTION OF THE ATMOSPHERE TO SOLAR DISTURBANCES
V. V. Mikhnevich Jun. 1979 14 p refs Transl. into ENGLISH from Transactions (Leningrad, 1974 p 168-180 Presented at the 1st All-Union Conf. on Sun Atmosphere Relations in Climate Theory and Weather Forecasts, Moscow, 30 Oct. - 1 Nov. 1972 Original language document previously announced as A74-37713 Transl. by Scientific Translation Service, Box 5456, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75500) Avail: NTIS HC A02/MF A01 CSCL 04A

The effect of solar flares on the thermosphere and the troposphere is investigated. It is found that during periods of geoeffect solar disturbances, there is a connection between phenomena in the upper and lower atmospheres and that variations in atmospheric parameters correlate with changes in the geomagnetic index. K.L.

N80-15705*# Business and Technological Systems, Inc., Seabrook, Md.
GLOBAL CRUSTAL RESPONSE MODEL Semiannual Report, 3 Apr. - 3 Oct. 1978
20 Oct. 1978 22 p
(Contract NAS5-25010)
(NASA-CR-159955) Avail: NTIS HC A02/MF A01 CSCL 08G

A computer program was developed for calculating the radial displacement due to the body tide as a function of spatial position and time. The positions of the moon and sun were evaluated by means of the Hill-Brown and Newcomb theories, respectively. Green's functions were utilized to simulate the elastic Earth responses due to point loads, a convolution program has been developed to evaluate the elastic Earth responses due to ocean loading by a given ocean tide constituent. These responses include radial and horizontal displacement, tilt and gravity acceleration, and strain tensor components. A.W.H.

N80-15706*# Miami Univ., Fla. Div. of Meteorology and Physical Oceanography.
NUMERICAL MODELING OF BAROCLINIC INSTABILITY Final Report, 2 Jun. 1978 - 14 Jun. 1979
J. F. Geisler 15 Dec. 1979 2 p
(Contract NAS8-32898)
(NASA-CR-161363) Avail: NTIS HC A02/MF A01 CSCL 04A

The Eady model of baroclinic instability applied to a rotating channel with Ekman layers at the top and bottom is extended to a beta-plane channel. Changes in the shape and position of the boundary separating the regions of axially symmetric and wavelike motion are predicted. K.L.

N80-15707*# Stanford Univ., Calif. Radioscience Lab.
THE INVESTIGATION OF MAN-MADE MODIFICATIONS OF THE IONOSPHERE Progress Report, 1 Sep. 1978 - 31 Dec. 1979
P. A. Bernhardt, A. V. daRosa, and K. M. Price Jan. 1980 16 p refs
(Grant NGR-05-020-001)
(NASA-CR-162579; SU-TR-19) Avail: NTIS HC A02/MF A01 CSCL 04A

Topics covered include: (1) the application of ionosphere modifications models to the simulation of results obtained when rocket-borne explosives were detonated in the ionosphere; (2) the problem of hypersonic vapor releases from orbiting vehicles; (3) measuring the electron content reduction resulting from the

firing of a Centaur rocket in the ionosphere; and (4) the preliminary design of the critical frequency tracker which displays the value of electron concentration at the peak of the F 2 region, in real time. A.R.H.

N80-15708*# Alaska Univ., Fairbanks. Geophysical Institute.
ACTIVE EXPERIMENTS USING ROCKET-BORNE SHAPED CHARGE BARIUM RELEASES
Eugene M. Wescott and T. N. Davis 15 Jan. 1980 84 p refs
(Grant NsG-6014)
(NASA-CR-162581) Avail: NTIS HC A05/MF A01 CSCL 04A

A reliable payload system and scaled down shaped charges were developed for carrying out experiments in solar-terrestrial magnetospheric physics. Four Nike-Tomahawk flights with apogees near 450 km were conducted to investigate magnetospheric electric fields, and two Taurus-Tomahawk rockets were flown in experiments on the auroral acceleration process in discrete auroras. In addition, a radial shaped charge was designed for plasma perturbation experiments. K.L.

N80-15709# Naval Research Lab., Washington, D. C.
A GLOBAL IONOSPHERIC MODEL
Joe Thomason, Glenn Skaggs, and John Lloyd 20 Aug. 1979 56 p refs
(ZF12151001)
(AD-A074370; AD-E000323) Avail: NTIS HC A04/MF A01 CSCL 04/1

This paper describes a global ionospheric model used by NRL to analyze the performance of high-frequency radar systems. The model described is based primarily on numerical maps derived from reports by a network of vertical sounding stations. Indices for the E, F sub 1, and F sub 2 layers are used to generate electron density profiles. An exponential tail is added to the E-region profile to account for D-region effects. Numerical maps of the sporadic-E indices are available but are not included in the electron density profile. This paper also describes several applications of the ionospheric model and includes an atlas of plasma frequency contour maps generated with the model. GRA

N80-15710# Naval Environmental Prediction Research Facility, Monterey, Calif.
MODELING THE REFRACTIVE INDEX STRUCTURE PARAMETER IN THE MARINE PLANETARY BOUNDARY LAYER Final Report
S. D. Burk, Andreas K. Goroch, Alan I. Weinstein, and Hans A. Panofsky (Pennsylvania State Univ., University Park) Jun. 1979 58 p refs
(AD-A074275; NEPRF-TR-79-03) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report summarizes the proceedings, conclusions and recommendations of a two-day workshop (30-31 Jan. 1979) on refractive index structure parameter, Cn(2), in the marine planetary boundary layer (MPBL). Scaling laws are described that are adequate to predict Cn(2) in the surface layer to an accuracy of approximately a factor of two. A stepwise procedure is described to predict Cn(2) using these scaling steps. No generally accepted quantitative scaling laws exist in the upper MPBL. Simple second-moment turbulence models hold the best promise for Cn(2) prediction in the upper MPBL at this time. After verification these models can be used by themselves or to generate upper MPBL scaling laws. GRA

N80-15711# Rhode Island Univ., Kingston. Dept. of Mathematics.
EXTREMELY HIGH LATITUDE AURORAS, PART 1 Final Report, 1 Jan. 1977 - 30 Sep. 1978
M. Susan Gussenhoven (Webb Associates, Yellow Springs, Ohio) Aug. 1979 73 p refs
(Contract F49620-77-C-0050; AF Proj. 2311)
(AD-A074989; AFOSR-79-1059TR) Avail: NTIS HC A04/MF A01 CSCL 04/1

The work under this contract had as its goal the time-dependent phenomenological modeling of the polar cap regions. The vehicle for modeling the caps has been to analyze the following collection of data: DMSP images showing polar cap auroras; DMSP electron measurements; hourly averages of the interplanetary magnetic field; ground magnetometer data from Thule; and magnetic indices. DMSP images for the winters of 1972-1973 and 1974-1975 provided consistently good records of the northern polar cap region and were used as the primary basis of the study. The DMSP images for these periods were traced and gridded in corrected geomagnetic coordinates and local geomagnetic time. The subset of cases for which auroras occur at above 80 degrees corrected geomagnetic latitude was identified and further categorized by local time interval of occurrence (morning, midnight, evening sectors). The occurrence of extremely high latitude aurora in each category was correlated with magnetic indices, magnetometer response at Thule, and solar wind parameters. The correlation of cap size as determined by poleward auroral boundaries, and the time variation of these with the above parameters was also made. GRA

N80-15712# Rice Univ., Houston, Tex. Dept. of Physics and Astronomy.
BIRKELAND CURRENTS AND RING CURRENTS IN THE COMPUTER SIMULATION OF THE SUBSTORM OF 19 SEPTEMBER 1976
M. Harel, R. A. Wolf, P. H. Reiff, and M. Smiddy 7 Feb. 1979 28 p refs
(Contract F19628-77-C-0005; AF Proj. 2311)
(AD-A073852; SR-1; AFGL-TR-79-0041) Avail: NTIS HC A03/MF A01 CSCL 04/1

Several computer runs simulating the behavior of the inner magnetosphere during a substorm-type event that occurred on 19 September 1976, have been completed and analyzed. The computer model simulates many aspects of the behavior of the closed-field-line portion of the Earth's magnetosphere, and the auroral and subauroral ionosphere. For these regions, the program self-consistently computes electric fields, electric currents, hot-plasma densities, plasma velocities and other parameters. Presented here are some highlights of the results of the event simulation. Predicted electric fields for several times during the event agree reasonably well with corresponding data from satellite S3-2. Detailed discussion is presented for a case of rapid subauroral flow that was observed on one S3-2 pass and is predicted by computer runs. The computed global distribution of Birkeland current agrees reasonably well with the observations of Iijima and Potemra. In the simulated substorm-type event, plasma-sheet ions are injected earthward of synchronous orbit near midnight and drift westward, forming a ring half-way around the Earth by the end of the simulation, 3 hours after substorm onset. The dispersion of ion energies on the dusk side near synchronous orbit has the form commonly observed by McIlwain and collaborators. It appears that the ions would form a complete ring if the simulation were continued for several more hours.
Author (GRA)

N80-15713# Air Force Geophysics Lab., Hanscom AFB, Mass.
AN ATMOSPHERIC TEMPERATURE PROFILE MEASURED WITH AN IN-SITU INFRARED RADIOMETER
R. A. McClatchey and A. D. dAgati May 1979 30 p refs
(AF Proj. 7670)
(AD-A074471; AFGL-TR-79-0100; AFGL-ERP-661) Avail: NTIS HC A03/MF A01 CSCL 04/1

A side-looking infrared radiometer operating in a narrow spectral interval in the 15 micrometers carbon dioxide band was flown on a balloon platform. Data were obtained over the altitude range from 9.4 to 30 km. The resulting radiance measurements are compared with calculations making use of independent rawinsonde measurements obtained during the balloon flight. These comparisons indicate a systematic discrepancy of a few percent at lower altitudes increasing to 20 percent near 20 km. This discrepancy is found to be consistent with a previous study of satellite based radiances. Possible sources of this discrepancy are investigated and rejected, leading the authors to question the assumption that the source function is equal to the Planck intensity. GRA

N80-15714# Air Force Geophysics Lab., Hanscom AFB, Mass.
TIME AND SPACE VARIATION OF DENSITY IN THE TROPICS
Arthur J. Kantor and Allen E. Cole 10 May 1979 18 p refs
(AF Proj. 6670)
(AD-A074472; AFGL-TR-79-0109; AFGL-ERP-662) Avail:

NTIS HC A02/MF A01 CSCL 04/1

A preliminary analysis of the time and space variability of atmospheric density over tropical regions was developed and is presented herein. Emphasis is placed on horizontal distances out to 200 nmi (370 km) and on time periods of from 1 to 12 hrs. Estimated rms differences to 200 nmi and the rms variability of density with time are provided for altitudes up to 60 km. GRA

N80-15715# Air Force Geophysics Lab., Hanscom AFB, Mass.
MIXING IN BILLOW TURBULENCE AND STRATOSPHERIC EDDY DIFFUSION
E. M. Dewan 10 Apr. 1979 33 p refs
(AF Proj. 6687)
(AD-A074466; AFGL-TR-79-0091; AFGL-ERP-659) Avail: NTIS HC A03/MF A01 CSCL 04/1

In order to estimate the rate of vertical transport due to turbulence in the stratosphere, it is necessary to know the degree of mixing that takes place in 'Kelvin-Helmholtz billow events.' This is estimated by means of a discrete model and the results are compared with published experimental observations. From these considerations it is concluded that a very large degree of mixing probably takes place in such events, and that, therefore, one must use the relation between the bulk vertical eddy diffusivity and layer diffusivity originally proposed by Rosenberg and Dewan instead of the simple one usually employed. GRA

N80-15716# Cornell Univ., Ithaca, N. Y. Lab. of Plasma Studies.
TEMPORAL AND SPATIAL POWER SPECTRUM STUDIES OF NUMERICAL SIMULATIONS OF TYPE 2 GRADIENT DRIFT IRREGULARITIES IN THE EQUATORIAL ELECTROJET
M. J. Keskinen, R. N. Sudan, and R. L. Ferch Jun. 1978 70 p refs
(Contract N00173-77-C-0240)
(AD-A073467; LPS-243) Avail: NTIS HC A04/MF A01 CSCL 04/1

Temporal and spatial power spectra from computer simulations of the equations modeling Type II irregularities in the equatorial electrojet are presented. The power spectra are computed using the code of Ferch and Sudan, averaging over times as long as 20 seconds. The dependence of the average frequencies and linewidths on wavelength and angle from the electrojet drift is studied. The mean frequencies obtained agree well with linear theory except at short wavelengths while the linewidths are greater than those predicted by the linear damping rates. The spatial power spectra were also computed and found to be approximately isotropic. GRA

N80-15717# Air Force Geophysics Lab., Hanscom AFB, Mass.
AIRBORNE ALL-SKY IMAGING OF EQUATORIAL AIRGLOW Final Report
E. J. Weber, J. Buchau, and J. G. Moore 21 Sep. 1980 45 p refs
(AF Proj. 4643)
(AD-A073716; AFGL-TR-78-0224) Avail: NTIS HC A03/MF A01 CSCL 04/1

Radio wave and optical experiments were conducted in March 1977 and March 1978 at low magnetic latitudes to investigate the effects of F region electron density irregularities on transionospheric communications links. Imaging photometer, ionosonde, 50 MHz backscatter radar and satellite amplitude scintillation measurements were used to arrive at a description of equatorial F-region disturbances. After sunset, regions of low electron density propagate from the bottomside, through the F-region peak and often reach to 1000 km altitude. These regions of low density, called bubbles or plumes, are visible as depletions in the 6300 A OI airglow; therefore, the size and motion of these depletions can be measured with an all sky imaging photometer. Electron density irregularities, with scale sizes from 3 m to 10 km, are found within these plumes, and give rise to amplitude scintillation, 50 MHz backscatter and spread F. This report presents a review of the experimental measurements used to arrive at the current description of equatorial F region plumes and associated irregularities. GRA

N80-15718# Los Alamos Scientific Lab., N. Mex.
FINITE ELEMENT METHOD FOR STUDYING THE TRANSIENT NONLINEAR THERMAL CREEP OF GEOLOGICAL STRUCTURES
C. A. Anderson and R. J. Bridwell Jun. 1979 36 p refs
(Contract W-7405-eng-36)
(LA-7883-MS) Avail: NTIS HC A03/MF A01

A finite element theory, suitable for describing the long term transient thermal creep of geomechanical structures where the material obeys an arbitrary type of creep law, is presented. The method takes into account large deformation effects, is stable for the large time steps required to model geophysical phenomena, and accurately simulates changing, incompressible, plastic flow fields. Applications of the theory to the prediction of long term creep and creep rupture of simple engineering structures are given. The theory is also applied to predict the thermal creep of layered media to study the mechanics of folding and rift formation. DOE

N80-15719# California Univ., Berkeley. Lawrence Berkeley Lab.
ARMA MODELS FOR EARTHQUAKE GROUND MOTIONS
M. K. Chang, J. W. Kwiatkowski, R. F. Nau, R. M. Oliver, and K. S. Pister Jan. 1979 86 p refs
(Contract W-7405-eng-48)
(UCRL-15084; ORC-79-1) Avail: NTIS HC A05/MF A01

Four major California earthquake records were analyzed by use of a class of discrete linear time domain processes commonly referred to as autoregressive/moving-average models. The traditional continuous models with parameter estimates based on spectral analysis were compared to the discrete models with parameters estimated by various maximum likelihood techniques applied to digitized acceleration data in the time domain. The methodology proposed is suitable for simulating earthquake ground motions in the time domain, and appears to be easily adapted to serve as inputs for nonlinear discrete time models of structural motions. DOE

N80-15720# California Univ., Livermore. Lawrence Livermore Lab.
GLOBAL OBSERVATION OF ATMOSPHERIC OZONE BY SATELLITE
J. E. Lovill, J. S. Ellis, and P. P. Weidhaas 2 Jul. 1979 7 p refs Presented at Intern. Conf. of Global Atmospheric Pollution, Boulder, Colo., 22 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-82028; CONF-790842-1) Avail: NTIS HC A02/MF A01

Infrared radiance data from a new series of satellites, the block 5D Defense Meteorological Satellite Program (DMSP) system, are presented. The accuracy of the satellite multichannel filter radiometer total ozone measurements is discussed. Comparisons are made against a specially selected network of surface-based total ozone measurement observations as well as total ozone measurements made by another satellite sensor. A map of satellite measured total ozone is presented and compared against the temperature analysis from radiosonde ascents made during the Southern Hemisphere winter. DOE

N80-15721# National Technical Information Service, Springfield, Va.
ATMOSPHERIC ECHO SOUNDING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug. 1979
Audrey S. Hundemann Sep. 1979 106 p Supersedes NTIS/PS-78/0916; NTIS/PS-77/0815; NTIS/PS-76/0698; NTIS/PS-75/641; NTIS/PS-75/045
(NTIS/PS-79/0989/8; NTIS/PS-78/0916; NTIS/PS-77/0815; NTIS/PS-76/0698; NTIS/PS-75/641; NTIS/PS-75/045) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Abstracts pertaining to equipment, design, and use of acoustic sounders are presented. Use of the sounders to sense the atmosphere for weather changes, temperature inversions, aircraft wakes, ionospheric properties, and other characteristics is discussed. (This updated bibliography contains 98 abstracts, 8 of which are new entries to the previous edition.) GRA

N80-15722# National Bureau of Standards, Washington, D.C. National Measurement Lab.
CHEMICAL KINETIC DATA NEEDS FOR MODELING THE LOWER TROPOSPHERE Final Report

John T. Herron, Robert E. Huie, and Jimmie A. Hodgeson Aug. 1979 108 p refs Workshop held at Reston, Va., 15-17 May 1978; sponsored in part by EPA
(PB-299439/0; NBS-SP-557; LC-79-600125) Avail: NTIS HC A06/MF A01 CSCL 04A

Six key problem areas in tropospheric chemistry are addressed: reactions of olefins with hydroxyl radicals and ozone; reactions of aldehydes; free radical reactions; reactions of oxides of nitrogen; reactions of aromatic compounds; and reactions of oxides of sulfur. The summary and list of major recommendations for further work, review papers, discussion summaries, contributed comments, recommendations, and an attendance list are included. GRA

N80-15723# Louisiana State Univ. and A&M Coll., Baton Rouge. Div. of Engineering Research.
EVALUATION OF THE VANE SHEAR TEST IN LOUISIANA Final Report
Jack K. Poplin, Ara Arman, and Niaz Ahmad (McClelland Engineers, Inc., Houston, Tex.) Dec. 1978 219 p refs Sponsored in part by Louisiana Dept. of Transportation and Development, Baton Rouge
(PB-298877/3; BULL-118; FHWA/LA-78-207L) Avail: NTIS HC A10/MF A01 CSCL 08M

In situ shear strengths measured by the vane shear test were compared with undrained shear strengths determined by laboratory unconfined and triaxial compression tests on samples taken by conventional tube sampling and on a few hand-carved samples. In situ shear strengths as determined by the vane shear test were from 2.0 to 2.5 times the shear strengths from laboratory tests on tube samples and were more comparable to shear strengths of hard-carved samples. Miniature vane shear tests on tube samples indicated shear strengths more comparable to laboratory strengths. Sensitivity indicated by in situ remolding with the vane was greater than sensitivity as determined by triaxial compression tests. GRA

N80-15724# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Technology Div.
SUMMER FELLOWSHIP IN SCIENTIFIC COMPUTING
Jeanne C. Adams, ed. and Linda C. Besen, ed. Apr. 1979 179 p refs
(Grant NSF ATM-77-13757)
(PB-301297/8; NCAR-TN-135+PROC) Avail: NTIS HC A09/MF A01 CSCL 04B

Contents: Nitrous oxide production in a shallow water environment; a study of the vertical vorticity field from numerical model simulations of a Colorado convective storm; An exactly reversible calculation of the rotational and divergent wind potentials in a limited area; Normal models of the GISS Global Circulation Model; Towards a two-dimensional model for odd nitrogen in the thermosphere; Secular variation of solar zenith angle--A factor in climatic change; An isentropic cross-section processor for an isentropic fine mesh numerical analysis model; and A method for computing parcel trajectories for a two-dimensional isentropic coordinate primitive equation model. GRA

N80-15725# Princeton Univ., N. J. Dept. of Civil Engineering.
AN ANALYTIC METHOD FOR STRONG MOTION STUDIES IN LAYERED MEDIA
H. Engin, A. Askar, and A. S. Cakmak 30 Jun. 1979 67 p
(Grant NSF 76-20027)
(PB-301116/0; NSF/RA-790128; Rept-79-SM-4) Avail: NTIS HC A04/MF A01 CSCL 08K

An analytic method is presented for calculating strong motion spectra and the response to arbitrary input in layered media. It is based on the removal of secular terms at resonance of the equations with polynomial linearity. Through a convenient parametrization of the frequency, the procedure allows one to deal with linear equations and permits the extension of the method to multilayer systems by use of transfer matrices. Analytical methods studied lead to nonlinear algebraic equations for the amplitudes of oscillation and are untractable in multilayer systems. This method is applied to wave amplification studies in geotechnical engineering. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-15726*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STRATOSPHERIC AEROSOL MODIFICATION BY SUPERSONIC TRANSPORT OPERATIONS WITH CLIMATE IMPLICATIONS
O. B. Toon, R. P. Turco (R and D Assoc., Marina Del Rey, Calif.), J. B. Pollack, R. C. Whitten, I. G. Poppoff, and P. Hamill (Systems and Applied Sciences Corp., Hampton, Va.) Jan. 1980 20 p refs
(NASA-RP-1058; A-7938) Avail: NTIS HC A02/MF A01 CSCL 04B

The potential effects on stratospheric aerosols of supersonic transport emissions of sulfur dioxide gas and submicron size soot granules are estimated. An interactive particle-gas model of the stratospheric aerosol is used to compute particle changes due to exhaust emissions, and an accurate radiation transport model is used to compute the attendant surface temperature changes. It is shown that a fleet of several hundred supersonic aircraft, operating daily at 20 km, could produce about a 20% increase in the concentration of large particles in the stratosphere. Aerosol increases of this magnitude would reduce the global surface temperature by less than 0.01 K. Author

N80-15727*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
DOBSON SPECTROPHOTOMETER OZONE MEASUREMENTS DURING INTERNATIONAL OZONE ROCKETSONDE INTERCOMPARISON
C. L. Parsons Jan. 1980 19 p refs
(NASA-TM-73284) Avail: NTIS HC A02/MF A01 CSCL 04B

Measurements of the total ozone content of the atmosphere, made with seven ground based instruments at a site near Wallops Island, Virginia, are discussed in terms for serving as control values with which the rocketborne sensor data products can be compared. These products are profiles of O3 concentration with altitude. By integrating over the range of altitudes from the surface to the rocket apogee and by appropriately estimating the residual ozone amount from apogee to the top of the atmosphere, a total ozone amount can be computed from the profiles that can be directly compared with the ground based instrumentation results. Dobson spectrophotometers were used for two of the ground-based instruments. Preliminary data collected during the IORI from Dobson spectrophotometers 72 and 38 are presented. The agreement between the two and the variability of total ozone overburden through the experiment period are discussed. A.W.H.

N80-15728*# City Coll. of the City Univ. of New York.
INVESTIGATION OF MODELS FOR LARGE-SCALE METEOROLOGICAL PREDICTION EXPERIMENTS Final Report
Jerome Spar 31 Dec. 1979 19 p refs
(Grant NGR-33-016-086)
(NASA-CR-162572) Avail: NTIS HC A02/MF A01 CSCL 04B

Forecast and climate simulation experiments were conducted with a medium mesh (8 degrees of latitude by 10 degrees of longitude) 7 layer climate model. The outputs emphasized are: (1) monthly mean forecasts for the months of October 1976 through February 1977 generated from global initial conditions for the first day of each month; and (2) a model climatology generated by running the model for five simulated years from one set of initial conditions (1 December 1967) and averaging the 5 outputs for each of the 12 calendar months. R.C.T.

N80-15729# Woods Hole Oceanographic Institution, Mass.
WOODS HOLE OCEANOGRAPHIC INSTITUTION COLLECTION OF CLIMATOLOGY AND AIR/SEA INTERACTION (CASI) DATA
Roger A. Goldsmith and Andrew F. Bunker Aug. 1979 84 p refs
(Contract N00014-74-C-0262; Grant NSF ATM-77-01475)
(AD-A075009; WHOI-79-70) Avail: NTIS HC A05/MF A01 CSCL 04/2

Scientists at Woods Hole routinely collect and analyze a considerable amount of data relating to the oceans of the world. Of the many different kinds of data, one particular subset concerns those events occurring at the sea surface. A large number of sea surface environmental observations have been collected at Woods Hole. These data, and the subsequent analyses generated from the Air/Sea Heat Flux and the Climatology study projects, have been collected and archived. This document describes the W.H.O.I./Climatology and Air/Sea Interaction (WHOI/CASI) data collection and provides an initial index to its various components. GRA

N80-15730# Naval Postgraduate School, Monterey, Calif.
REFINEMENT OF A STATISTICAL DIAGNOSTIC MODEL OF MARINE FOG USING FNWC MODEL OUTPUT PARAMETERS M.S. Thesis
Steve Oneal Ouzts Jun. 1979 91 p refs
(AD-A073959; NPS63-79-002) Avail: NTIS HC A05/MF A01 CSCL 04/2

This study represents a continuation of the development of a model output statistics scheme to specify marine fog over the open ocean and in coastal waters. Thirty-seven direct and derived Fleet Numerical Weather Central model output parameters, monthly climatological fog frequencies, combinations of the aforementioned parameters (i.e. interactive parameters) and a persistence parameter are used as predictors in a stepwise multiple linear regression approach to estimate a predictand defined as marine fog probability. The predictand is categorized in two ways, in one case (FOGCAT 1) as smoothed probabilities for 0 to 100% as a function of present weather, past weather, visibility and low cloud type; and, in another case (FOGCAT 2) as a limited number of discrete probabilities (to include 0 and 100%) derived from present weather, past weather and visibility only. This study derives diagnostic regression equations only, using as a dependent data sample over 24,000 surface synoptic ship observations at 0000 GMT for June through August 1976 and 1977. The predictor parameters contributing most significantly to the variance are sensible and evaporative heat fluxes, monthly climatologial fog frequencies, and meridional wind speed. GRA

N80-15731# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
EVALUATION OF THE SATURATION RESISTANT CROSS-WIND SENSOR
Ruben Rodriguez and William J. Vechione Jul. 1979 68 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A074276; ERADCOM/ASL-TR-0035) Avail: NTIS HC A04/MF A01 CSCL 04/2

Integrated path crosswinds were measured at Biggs Optical Range, Biggs Army Airfield, Fort Bliss, Texas, during the period of 31 January to 8 March 1978 with the Saturation Resistant Crosswind Sensor, a bistatic system that measures crosswinds by detecting and analyzing the movement of atmospheric scintillations. Data collected with this sensor were compared to integrated path wind averages measured by the calibrated anemometer array. This report presents X-Y scatter plots, derived weighting functions, and wind measurement comparison plots. The results of the tests show that the major weighting (or contribution of thermal turbulence) to the system optics with a 500 m baseline is centered about 350 m from the receiver and approximates a slope intercept form Y = 0.85X - 10.02. With a 2,000 m baseline, the weighting function maximum is shifted to about 1400 m and approximates the slope intercept form Y = 1.57X - 0.43. GRA

N80-15732# City Univ. of New York, N. Y. Inst. of Marine and Atmospheric Sciences.
TWINDX: A PLANETARY BOUNDARY LAYER MODEL FOR THE WINDS IN EXTRATROPICAL AND TROPICAL OCEAN AREAS Final Report
Willard J. Pierson Jun. 1979 93 p refs
(Contract N00014-77-C-0206; WF52551792)
(AD-A074337; NEPRF-CR-79-02) Avail: NTIS HC A05/MF A01 CSCL 04/2

The theory and programming details of a planetary boundary layer model that describes the winds from the surface of the ocean to several hundred meters in the tropics and from the surface to the gradient wind level in extratropical regions are given. The model, called TWINDX for Trade Winds and Wind Expanded Scale, is for use on a 123 by 123 polar stereographic projection. The required input fields are the atmospheric pressure at the sea surface, and the sea surface temperature for the extratropical regions. For the tropical regions, the sea surface pressure field and field for the height of the lifting condensation level are needed. Various options are given, and additional options and improvements are described. The outputs are the vector wind at an elevation of 19.5 meters and the vector wind that would have been measured in a neutrally stratified atmosphere at an elevation of 19.5 meters, along with other fields, as options, that are useful for analysis and interpretation. The vector wind for a neutral stratification can then be compared with the output of the SASS on SEASAT to remove aliases and provide a wind field that can, in turn, be used to improve on the initial values required for a numerical weather prediction. Since the preparation of this report, additional material on SEASAT winds and the planetary boundary layer has appeared; a list of supplementary references has been added. GRA

N80-15733# Naval Environmental Prediction Research Facility, Monterey, Calif.
A PRELIMINARY ANALYSIS OF MESOSCALE EFFECTS OF TOPOGRAPHY ON TROPICAL CYCLONE-ASSOCIATED SURFACE WINDS Final Report
S. Brand, R. P. Chambers, H. J. C. Woo, J. E. Cermak, and J. J. Lou Jul. 1979 42 p refs
(WF52551792)
(AD-A074812; NEPRF-TR-79-04) Avail: NTIS HC A03/MF A01 CSCL 04/2

An analysis is made of the influence of topography on tropical cyclone-associated strong surface wind conditions for Subic Bay, Republic of the Philippines, by means of an environmental wind tunnel. Surface flow patterns were deduced by smoke and surface oil films, while isotach and gust values were obtained by hot wire anemometers. Laboratory results show the significant effects of the mountainous regions surrounding the Subic Bay harbor complex and indicate preferred shelter locations. These results are compared with synoptic observations and a high-resolution (0.19 n mi) diagnostic, one-level, primitive equation model. Where direct comparisons can be made, all techniques appear to show qualitative agreement. GRA

N80-15734# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
EDWARDS AFB, LANCASTER, CALIFORNIA, REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO) Final Report
9 Feb. 1979 501 p
(AD-A074691; USAFETAC/DS-79/051) Avail: NTIS HC A22/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Edwards AFB, Lancaster, California. It contains the following parts: (A) weather conditions; atmospheric phenomena; (B) precipitation, snowfall and snow depth (daily amounts and extreme values); (C) surface winds; (D) ceiling versus visibility; sky cover; (E) psychrometric summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew-point temperatures and relative humidity); and (F) pressure summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-15735# Air Force Geophysics Lab., Hanscom AFB, Mass.
CIRRUS PARTICLE DISTRIBUTION STUDY, PART 4
Donald J. Varley and Arnold A. Barnes, Jr. 18 Jun. 1979 91 p refs
(AF Proj. 317J)
(AD-A074763; AFGL-TR-79-0134-Pt-4; AFGL-AFSG-413-Pt-4)
Avail: NTIS HC A05/MF A01 CSCL 04/2

This is the fourth in a series of reports presenting particle distribution data acquired in cirrus clouds over the western U.S. The data herein were obtained 21 March 1978 by an instrumented MC-130E near Albuquerque, N. Mex. The area was under the influence of a slight upper level ridge, and the cirrus appeared related to jet stream winds. No significant surface weather was present at the time. Results include the following: (1) the largest particles measured were near 2500 micrometers, but there were only one or fewer of these per m3; (2) occasional particles as large as 1300 micrometers were recorded in what visually was cloud-free air; (3) few of the particles could be recognized in any known classification system but those most frequently recognized were bullet rosettes; (4) the PMS 2-D data revealed particle-type changes occurring in 5 sec or less of flight time; (5) a halo around the sun was periodically seen when mixed-type crystals containing bullet rosettes were recorded; (6) varying numbers of small particles (the difference between 1 to 28 micrometers) were recorded almost continually, even on clear air, while the aircraft was between 23,000 ft (7.0 km) and 27,300 ft (8.3 km) MSL; (7) computed ice water content values generally decreased with height and increased with temperature in the cirriform clouds sampled; (8) particle size spectra were seldom exponential for particles smaller than approximately 250 micrometers; and (9) bimodal peaks were frequent in the population distribution near 100 and 250 micrometers. GRA

N80-15736# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NUMBER 306, ROUND NUMBER B-26, 9 JULY 1979
Jul. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073394; ERADCOM/ASL-DR-1043) Avail: NTIS HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19702A GSRS, Missile Number 306, Round Number B-26, are presented in tabular form. GRA

N80-15737# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19701A GSRS, MISSILE NUMBERS 304, 305, 307, ROUND NUMBERS B-22, B-23, B-24, 5 JULY 1979
Jul. 1979 18 p
(DA Proj. 1T6-65702-D-126)
(AD-A073392; ERADCOM/ASL-DR-1041) Avail: NTIS HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19701A GSRS, Missile Numbers 304, 305, 307, Round Numbers B-22, B-23, B-24, are presented in tabular form. GRA

N80-15738# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19702A GSRS, MISSILE NUMBER 321, ROUND NUMBER B-25, 9 JULY 1979
Jul. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073393; ERADCOM/ASL-DR-1042) Avail: NTIS HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19702A GSRS, Missile Number 321, Round Number B-25, are presented in tabular form. GRA

N80-15739# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19701A GSRS, MISSILE NUMBER 022, ROUND NUMBER B-21, 5 JULY 1979
Jul. 1979 17 p
(DA Proj. 1T6-65702-D-126)
(AD-A073391; ERADCOM/ASL-DR-1040) Avail: NTIS HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19701A GSRS, Missile Number 022, Round Number B-21, are presented in tabular form. GRA

N80-15740# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE DYNAMICS OF MATERIAL LAYERS
William D. Ohmstede Jul. 1979 50 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A073728; ERADCOM/ASL-TR-0036) Avail: NTIS HC A03/MF A01 CSCL 04/2
Shallow-fluid equation models have been applied to several Army problem areas, especially those associated with atmospheric transport and diffusion. The objective of this report is to present the development of a system of equations which govern the behavior of material atmospheric layers and which retain the advantages of the shallow-fluid equations but are more generally suitable for atmospheric analysis. The report consists of three major sections. The first section presents a formal derivation of what therein is defined as the 'Material Layer Equations.' The second section addresses some of the practical considerations involved in applications of the material layer equations. Although the presentation of numerical algorithms for specific applications of the material layer equations is beyond the scope of this report, the third section does present elementary examples of how the material layer equations may be specialized to address specific atmospheric analysis problems. It is concluded that the material layer approach is most useful when the matter of concern is the transport and diffusion of material such as from NBC weapons or smoke. GRA

N80-15741# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 14822B LANCE, MISSILE NUMBER 4390, ROUND NUMBER 334-AST
Jun. 1979 30 p
(DA Proj. 1T6-65702-D-126)
(AD-A073387; ERADCOM/ASL-DR-1036) Avail: NTIS HC A03/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 14822 Lance, Missile Number 1036, Round Number 334-AST, are presented in tabular form. GRA

N80-15742# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19304DT GSR, MISSILE NUMBERS 1070 AND 1048, ROUND NUMBERS V-47 AND V-48, 28 JUNE 1979
Jun. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073389; ERADCOM/ASL-DR-1038) Avail: NTIS HC A02/MF A01
Meteorological data gathered for the launching of 19304DT GSRS, Missile Numbers 1070 and 1048, Round Number V-47 and V-48, are presented in tabular form. GRA

N80-15743# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19304B GSRS, MISSILE NUMBERS 1029, 1050, 1054, 1073, 1074, 1056, ROUND NUMBERS V-49, V-50, V-51, V-52, V-53, V-54, 2 JULY 1979
Jul. 1979 19 p
(DA Proj. 1T6-65702-D-126)
(AD-A073390; ERADCOM/ASL-DR-1039) Avail: NTIS HC A02/MF A01 CSCL 04/2
Meteorological data gathered for the launching of 19304B GSRS, Missile Nos. 1029, 1050, 1054, 1073, 1074, 1056, Round, Nos. V-49, V-50, V-51, V-52, V-53, V-54, are presented in tabular form. GRA

N80-15744# Weather Wing (3rd), Offutt AFB, Nebr.
MOISTURE ADVECTION AND THE SANGSTER CHART
Carl A. Johnson 18 Jun. 1979 49 p refs
(AD-A073432; Rept-3-WW-TN-79-1) Avail: NTIS HC A03/MF A01 CSCL 04/2
This technical note discusses clouds, precipitation and upper low movements as they were observed to occur with certain type boundary layer moisture advection patterns. Moisture advection was calculated using Sangster chart winds and surface mixing ratios. GRA

N80-15745# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS (SSMO). SELECTED SOUTH PACIFIC ISLAND MARINE AREAS, VOLUME 2. AREA 9: ISLE WALLIS. AREA 10: SAMOA ISLANDS. AREA 11: NEW CALEDONIA.

AREA 12: NEW HEBRIDES ISLANDS. AREA 13: FIJI ISLANDS. AREA 14: TONGA ISLANDS. AREA 15: NIUE ISLAND. AREA 16: RAROTONGA ISLAND (LOWER COOK ISLANDS)
Sep. 1979 644 p
(AD-A073446) Avail: NTIS HC A99/MF A01 CSCL 04/2

This report presents marine climatological data for areas 9 through 16 in 21 different tables including weather occurrence, wind direction and speed, cloud amount, ceiling height, visibility, precipitation, dry bulb, relative humidity, air-sea temperature difference, sea height and period sea surface temperature and sea level pressure. GRA

N80-15748# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS (SSMO). SELECTED SOUTH PACIFIC ISLAND MARINE AREAS. VOLUME 1. AREA 1: NAURU ISLAND AND OCEAN ISLAND. AREA 2: GILBERT ISLANDS. AREA 3: CANTON AND PHOENIX ISLANDS. AREA 4: CHRISTMAS AND JARVIS ISLANDS. AREA 5: SOLOMON ISLANDS, NORTHEAST. AREA 6: SOLOMON ISLANDS, SOUTHWEST. AREA 7: FUNAFUTI ATOLL. AREA 8: MARQUESAS ISLANDS
Sep. 1979 643 p
(AD-A073445) Avail: NTIS HC A99/MF A01 CSCL 04/2

This report presents marine climatological data for areas 1 through 8 in 21 different tables including weather occurrence, wind direction and speed, cloud amount, ceiling height, visibility, precipitation, dry bulb, relative humidity, air-sea temperature difference, sea height and period, sea surface temperature and sea level pressures. GRA

N80-15747# State Univ. of New York at Buffalo. Atmospheric Sciences Research Center.
CONSIDERATIONS IN THE OPTICAL CHARACTERIZATION OF THE ATMOSPHERE
James E. Jiusto and Richard D. H. Low, ed. White Sands, N. Mex. Army Electron. Res. and Develop. Command Jul. 1979 26 p refs
(Contract DAAG29-76-D-0100; DA Proj. 1L1-62111-AH-71)
(AD-A073480; ERADCOM/ASL-CR-79-0100-3) Avail: NTIS HC A03/MF A01 CSCL 04/2

The U.S. Army uses various types of electro-optical devices involving wavelengths from the visible to the near infrared. The performance of these sensors can be adversely affected by turbid atmospheres, especially those containing fog and haze. This report provides a brief review of the characteristics of fogs and hazes and offers a few recommendations on fog and haze measurements. In particular, attempts are made to answer such questions as: (1) whether the fog and haze characteristics found in some United States localities are comparable to those in certain places in West Germany, (2) whether the present standard meteorological measurements made at weather stations are suitable for determining fog optical properties, (3) whether the current fog numerical modeling would be relevant to field operations, and (4) what basic measurements are needed to describe adequately the foggy and hazy environments. Finally, an example of fog and haze measurements conducted on the campus of the State University of New York at Albany is briefly described. GRA

N80-15748# Science Applications, Inc., McLean, Va. Ocean Science Div.
THE EFFECT OF INACCURACIES IN METEOROLOGICAL PARAMETERS ON ONE-DIMENSIONAL FORECASTS OF UPPER OCEAN THERMAL STRUCTURE Final Report, Feb. 1978 - Aug. 1979
R. Michael Clancy Jul. 1979 63 p refs
(Contract N00014-78-C-0287)
(AD-A073539; SAI-79-880-WA) Avail: NTIS HC A04/MF A01 CSCL 04/2

A one-dimensional model has been used to investigate the effect of inaccuracies in meteorological parameters on forecasts of upper ocean thermal structure. Vertical eddy fluxes of heat, salinity, and momentum in the oceanic mixed layer are parameterized using the Level-2 turbulence closure model of Mellor and Yamada (1974). Surface eddy fluxes of sensible heat, latent heat, and momentum are related to the imposed meteorological parameters through a bulk aerodynamic formulation. Surface fluxes of solar and infrared radiation are parameterized with the formulas of Wyrtki (1965). The temperature anomaly in the ocean forecast produced by inaccuracies in the meteorological parameters diffuses rapidly downward from the surface to within a few meters of the mixed layer base. Its downward diffusion is much slower below this level and this tends to produce a relatively large vertical gradient in temperature anomaly near the base of the mixed layer which may have important implications for acoustic modeling. Both the depth of the mixed layer and the magnitude of the mixed layer temperature anomaly are found to be nonlinear functions of the inaccuracies in the potential temperature, humidity, and wind speed of the atmospheric mixed layer. Estimates of the time evolution of the inaccuracies in the air temperature, humidity, and wind speed during an actual operational forecast situation are made. GRA

N80-15749# Science Applications, Inc., McLean, Va. Ocean Science Div.
A MODEL OF DIURNAL VARIABILITY OF THE OCEAN-ATMOSPHERE SYSTEM IN THE UNDISTURBED TRADE WIND REGIME Final Report, Feb. 1978 - Aug. 1979
R. Michael Clancy Jul. 1979 130 p refs
(Contract N00014-78-C-0287)
(AD-A073540; SAI-79-807-WA) Avail: NTIS HC A07/MF A01 CSCL 04/2

One-dimensional coupled air-sea models are used to compare the responses to diurnal heating of a diffusive model and a bulk model of the oceanic mixed layer, and to investigate the diurnal variability of the upper ocean and lower atmosphere in the undisturbed trade wind regime. The diffusive model of the oceanic mixed layer uses the Level-2 turbulence closure theory of Mellor and Yamada (1974) while the bulk model uses the entrainment hypothesis and mean-turbulent-field modeling technique of Garwood (1977). The diurnal fluctuation of the surface sensible plus latent heat flux is controlled by both direct radiational heating of the atmosphere and direct radiational heating of the ocean. However, the amplitude of this fluctuation is about two orders of magnitude smaller than the amplitude of the surface solar flux which is primarily responsible for driving the diurnal sea surface temperature fluctuation. Although the sea surface temperature fluctuation alters the surface solar flux through its influence on cloud cover, this alteration is extremely small. Consequently, the feedback loop between the ocean and the atmosphere is exceedingly weak at the diurnal time scale. GRA

N80-15750# Oregon State Univ., Corvallis. Dept. of Atmospheric Science.
SOLAR ENERGY METEOROLOGICAL RESEARCH AND TRAINING SITE, REGION 5 Annual Report, 30 Sep. 1977 - 29 Sep. 1978
C. R. N. Rao and E. W. Hewson Jan. 1979 33 p refs
(Grant EY-77-G-06-1059)
(DOE/ET/20172-1) Avail: NTIS HC A03/MF A01

The primary facility for the acquisition of research quality solar radiation and solar energy related meteorological data is described. The training program established with the introduction of two, two-quarter courses on solar radiation and meteorological measurements and on atmospheric radiative processes is discussed. Global irradiance measurements made at the five sites described are presented. DOE

N80-15751# Los Alamos Scientific Lab., N. Mex.
NORTHWEST NEW MEXICO BOUNDARY LAYER EXPERIMENT
J. A. Archuleta, S. Barr, R. C. Carlos, W. E. Clements, J. Labry, L. Wangen, and S. K. Wilson Oct. 1978 37 p refs
(Contract W-7405-eng-36)
(LA-7525-MS) Avail: NTIS HC A03/MF A01

A 24 hour meteorological experiment was performed in the San Juan Basin of northwestern New Mexico with an emphasis on the diurnal variations of boundary layer wind, temperature, and turbulence structure. Hourly profiles of wind and temperature were observed to an altitude of 3 km above ground concurrently with photographs of a nearby power plant plume. The plume behavior is discussed in relation to the meteorological conditions at its elevation, and with surface based meteorological observations. DOE

N80-15752# National Technical Information Service, Springfield, Va.
CLEAR AIR TURBULENCE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug. 1979
Guy E. Habercom, Jr. Sep. 1979 309 p Supersedes NTIS/PS-78/0938; NTIS/PS-77/0857; NTIS/PS-76/0705; NTIS/PS-75/761; NTIS/PS-75/008
(NTIS/PS-79/0972/4; NTIS/PS-78/0938; NTIS/PS-77/0857; NTIS/PS-76/0705; NTIS/PS-75/761; NTIS/PS-75/008) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Clear air turbulence and its relationship to air transportation is documented in the cited research reports. Its meteorological occurrences, its detection, and aircraft encounters with the phenomena are investigated. This updated bibliography contains 293 abstracts, 5 of which are new entries to the previous edition. GRA

N80-15753# National Weather Service, Silver Spring, Md. Office of Hydrology
PRECIPITABLE WATER OVER THE UNITED STATES. VOLUME 2: SEMIMONTHLY MAXIMA
Francis P. Ho and John T. Riedel Jul. 1979 369 p refs Sponsored in part by Corps of Engr., Washington, D.C. and Soil Conserv. Serv., Washington, D.C.
(PB-300870/3; NOAA-TR-NWS-20-Vol-2; NOAA-79082201) Avail: NTIS HC A16/MF A01 CSCL 04B

The observed semimonthly maxima and means of the series of semimonthly maxima precipitable water are presented in tabular, graphical, and map form for all radiosonde stations in the contiguous United States for the period 1946-72 and for Alaska for the period 1950-69. The data are given by layers from the surface to 400 mb from twice daily observations. GRA

N80-15754# National Weather Service, Honolulu, Hawaii.
APPLICATION OF THE ZERO RELATIVE VORTICITY LINE IN SYNOPTIC FORECASTING
Hans E. Rosendal Aug. 1979 40 p refs
(PB-300790/3; NOAA-TM-NWS-PR-20; NOAA-79082005) Avail: NTIS HC A03/MF A01 CSCL 04B

The concept of relating, via the 500 mb zero relative vorticity line, surface convergence, as expressed in active weather and fronts, to a narrow zone of divergence aloft associated with the upper jet is examined. The application of this technique towards weather forecasting is discussed. GRA

N80-15755# National Severe Storms Lab., Norman, Okla.
AN ANALYSIS OF CLEAR AIR PLANETARY BOUNDARY LAYER WIND SYNTHESIZED FROM NSSL'S DUAL DOPPLER-RADAR DATA
Myron I. Berger and R. J. Doviak Jun. 1979 78 p refs
(Contract DOT-FAA76WAI-622)
(PB-300865/3; NOAA-TM-ERL-NSSL-87; NOAA-79081601) Avail: NTIS HC A05/MF A01 CSCL 04B

Acquisition of wind data and synthesis of the data to grid points are discussed, and it is shown by correlation techniques that the theoretically estimated velocity variance at a grid point caused by measurement technique is small enough to detect true kinematic features in the perturbation wind fields. The kinematic structure of these perturbation wind fields is analyzed and compared to results produced by analytical and numerical models. Spatial spectrum analysis and band-pass filtering of the Doppler synthesized winds are used to aid in interpreting the structure of the wind fields. It is shown that the data are consistent with model predictions for a convectively unstable and moderately sheared PBL that existed during data collection. GRA

N80-15756# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
SESAME (SEVERE ENVIRONMENTAL STORMS AND MESOSCALE EXPERIMENT), 1979 PLANS FOR OPERATION AND DATA ARCHIVAL
Ronnie L. Alberty, ed. (National Severe Storms Lab., Norman, Okla.) and Stanley L. Barnes, ed. Apr. 1979 75 p
(PB-299878/9; NOAA-79081001) Avail: NTIS HC A04/MF A01 CSCL 04B

Summaries are given on the following presentations: regional subprogram requirements; boundary layer subprogram requirements; applications subprogram requirements; storm scale subprogram requirements; satellite observations; aircraft observations; radar and surface network observations; joint Doppler operational project for 1979; operational strategies and priorities; and data archival. GRA

N80-15757# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
SYSTEM CONSIDERATIONS OF A LONG RANGE COHERENT LIDAR WIND SENSOR WITH PARTICULAR EMPHASIS ON REAL WEATHER EFFECTS
F. J. Pratt, R. M. Huffaker, T. R. Lawrence, and R. Loveland (Army Electronics Command, White Sands Missile Range, N. Mexico) Jun. 1979 153 p refs Sponsored in part by Army Electronics Command, White Sands Missile Range, N. Mexico
(PB-299972/0; NOAA-TM-ERL-WPL-42; NOAA-79080904) Avail: NTIS HC A08/MF A01 CSCL 04B

The performance of a pulsed coherent lidar system for remote wind measurements in the troposphere is documented. Transmitted peak power pulse width, mirror sizes, and receiver sensitivity are specified. The response of the system in clean air is considered, and the effects of turbulence and the nature of the return from the aerosol are estimated. The climatologies of central Germany and Missouri are used to estimate the performance of the system in cloudy weather. GRA

N80-15758# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
METEOROLOGICAL EFFECTS OF OIL REFINERY OPERATIONS IN LOS ANGELES
R. F. Pueschel, F. P. Parungo, E. W. Barrett, D. L. Wellman, and H. Proulx Jul. 1979 68 p refs
(PB-300720/0; NOAA-TM-ERL-APCL-22; NOAA-79081403) Avail: NTIS HC A04/MF A01 CSCL 04B

From airborne in situ measurements of gases and aerosol size distributions and from post-flight chemical analyses of sample particles, it was found that oil refinery operations in southern Los Angeles can modify clouds in the vicinity. The refinery effluents increased the concentration of aerosols in the size range between 0.05 micro m and 2.5 micro m particle radius. Furthermore, although the sulfate aerosol in the area has a stabilizing effect on clouds, the clouds downwind of the refineries were found to be destabilized by the nitrate aerosol. GRA

N80-15759# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.
ERROR CHARACTERISTICS OF SATELLITE-DERIVED WINDS
Lester F. Hubert and Albert Thomasell, Jr. Jun. 1979 44 p refs
(PB-300754/9; NOAA-TR-NESS-79; NOAA-79081401) Avail: NTIS HC A03/MF A01 CSCL 04B

Errors of winds derived from geostationary satellite measurements are estimated by analysis of differences between satellite and rawin observations. It is estimated that the NESS winds contain root mean square errors of 4.7 m/s for low levels and 8.5 m/s for upper levels. It was concluded that the accuracy of these data can be increased by reducing system noise, but improving their meteorological value can be realized only by modifying procedures to enable clouds to be traced in meteorologically active regions. GRA

N80-15760# Mississippi Univ., University. Dept. of Physics and Astronomy.
STORM RESEARCH Final Report, 1 Mar. - 30 Jun. 1978
Roy T. Arnold Jun. 1978 24 p refs
(Grant NOAA-04-80I-9)
(PB-300299/5; NOAA-79080802) Avail: NTIS HC A02/MF A01 CSCL 04B

Lightning observations made from a mobile laboratory jointly equipped with support by NSSL, UM and ONR are presented. Topics covered are: (1) electrical measurements made on severe storms with the mobile laboratory; (2) a description of a portable TV monitor which was used successfully to document lightning flashes and some cloud features; (3) cloud-to-ground lightning flash electric field change records obtained for both positive and negative flashes; and (4) very short duration bright, multiply branched CG flashes occurring near the radar weak echo region

of severe storms 'near' the time that either tornadoes or changing wall cloud features are observed. GRA

NBO-15761# Meteorology Research, Inc., Altadena, Calif.
CHANGES IN CLOUD BASE PRECIPITATION PARTICLE SIZE-DISTRIBUTIONS AS A RESPONSE VARIABLE TO SEEDING Technical Report, Jan. - Apr. 1979
D. M. Takeuchi 26 Jun. 1979 31 p refs
(Contract DI-14-06-D-7699)
(PB-299549/6; MRI-79-TR-1683) Avail: NTIS HC A03/MF A01 CSCL 04B

Precipitation particle size distribution measurements made near the base regions of summertime convective clouds near Miles City, Montana are evaluated. For given intensities, it is shown that the natural size spectra differs significantly among natural clouds producing precipitation of three primary types: (1) snow, (2) rain and/or graupel, and (3) hail with graupel and/or rain. Primary differences occur at the larger particle sizes with the hail spectra showing significantly higher number concentrations than the other two spectra types. Seeding is shown to increase (decrease) the number concentrations of the larger (smaller) particles in snow producing clouds. GRA

NBO-15762# National Weather Service, Salt Lake City, Utah.
ARIZONA COOL SEASON CLIMATOLOGICAL SURFACE WIND AND PRESSURE GRADIENT STUDY
Ira S. Brenner May 1979 20 p ref
(PB-298900/2; NOAA-TM-NWS-WR-144; NOAA-79070603) Avail: NTIS HC A02/MF A01 CSCL 04A

The average sea-level pressure gradients which produce sustained surface winds above 8 kts for at least six consecutive hours during the cool season at predetermined key stations in or adjacent to Arizona are investigated. Only wind directions from northerly or easterly components are included in the developmental data sample. Graphs are provided in the development data sample. Graphs are provided which relate the derived pressure gradients to varying surface wind speeds at each key station. GRA

NBO-15763# Control Data Corp., Minneapolis, Minn.
DIFFUSION COEFFICIENTS FROM METRAC SYSTEM TURBULENCE MEASUREMENTS Final Report
W. H. Jasperson May 1979 70 p refs
(Contract EPA-68-02-2444)
(PB-300339/9; EPA-600/4-79-034) Avail: NTIS HC A04/MF A01 CSCL 04B

The results from 34 'constant level' tetroon flights made near St. Cloud, Minnesota, and tracked with the Metrac positioning system are presented. These flights were made throughout the year and primarily at heights between 700 and 1400 meters above the surface. Flight times ranged in length from 2100 to 6000 seconds. Three dimensional velocity variances, autocorrelation functions, power spectra and diffusion coefficients are presented. Relationships showing an increase of vertical velocity variance with decreasing atmospheric stability and with increased wind speed are illustrated. GRA

NBO-15764# National Weather Service, Silver Spring, Md. Meteorological Services Div.
LOW-LEVEL WIND SHEAR: A CRITICAL REVIEW
Julius Badner Apr. 1979 90 p refs
(PB-300715/0; NOAA-TM-NWS-FCST-23) Avail: NTIS HC A05/MF A01 CSCL 04B

Theoretical and observational background information on the occurrence of low-level wind shear is provided. Aircraft takeoff, approach and landing incidents related to wind shear are cited. Graphs and tables which can aid in the forecasting of low level wind shear under various conditions are provided. The occurrence of wind shear with synoptic scale systems and with convective systems is described. GRA

NBO-15765# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.
GATE RADAR CAPPI DERIVATION FOR THREE-DIMENSIONAL REFLECTIVITY ANALYSES
Peter J. Pytlowany, Frank P. Richards, and Michael D. Hudlow Jul. 1979 38 p refs
(PB-301263/0; NOAA-TM-EDIS-27; NOAA-79083002) Avail: NTIS HC A03/MF A01 CSCL 04B

Methodology and processing techniques used in deriving constant-altitude, plan-position-indicator (CAPPI) arrays of mean reflectivities from GATE Oceanographer radar tilt-sequence data are presented. Input data adjustments and corrections are specified and basic assumptions and motivations relating to particular decisions are discussed. The defining equations and algorithms applied in generating CAPPI arrays are developed for a mean GATE atmosphere. Computer aspects are discussed and performance results are summarized. Data problems and limitations are discussed, and an assessment of data quality and potential sources of error is given to aid in characterizing the quantitative and qualitative aspects of the data. GRA

NBO-15766# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Analysis and Prediction Div.
DAILY HIGH-LATITUDE 150 mb PRESSURE MAPS FROM TWERLE (TROPICAL WIND, REFERENCE LEVEL AND ENERGY CONVERSION EXPERIMENT) AND RAWINSONDES. PART 1: 16 NOVEMBER 1975 - 31 JANUARY 1976
Nadav Levanon, Yona Eyal, Paul R. Julian, Dennis Shea, and Verner E. Suomi Jul. 1979 97 p refs Prepared in cooperation with Tel-Aviv Univ., Israel and Wisconsin Univ.-Madison
(Grant NSF ATM-77-23757)
(PB-301343/0; NCAR-TN-141+STR) Avail: NTIS HC A05/MF A01 CSCL 04B

Winds, temperatures, pressures, and altitudes were used to prepare daily 150 mb constant pressure charts for the austral summer 1976 for latitudes poleward of 45 S. Conventional rawinsonde upper air data were used when available. In addition, full hemispheric charts for two selected days in January 1976 are shown. These charts, analyzed by hand, are shown to illustrate another method of accomodating the asynoptic and Lagrangian nature of the TWERLE data. Some discussion of these maps is included. GRA

NBO-15767# National Center for Atmospheric Research, Boulder, Colo. Convective Storms Div.
FIELD OBSERVATIONS OF KINEMATICS OF HAILSTONES
Richard Matson and Arlen W. Huggins Jun. 1979 79 p refs
(Grant NSF ATM-77-23757)
(PB-301387/7; NCAR-TN-139+STR) Avail: NTIS HC A05/MF A01 CSCL 04B

The kinematic behavior of naturally falling hailstones was studied using stroboscopic photography in a mobile van. About 84 percent of the hailstones photographed were classified spheriodal, the remainder being roughly conical. Rotational rates were measured for 6 percent of the stones sampled and found to have a median value of 40 Hz. Velocity data were obtained for 621 hailstones in the diameter range 5-25 mm. Hailstone fallspeed and hailstone axis ratio are shown to be negatively correlated. Hailstone drag coefficients, inferred from vertical velocity measurements, are found to be much higher than most commonly quoted values. The time dependence of hailstone parameters is presented for two storms and the implication of these and the other findings is discussed. GRA

NBO-15768# Florida State Univ., Tallahassee. Dept. of Meteorology.
ATMOSPHERIC STRUCTURAL VARIATIONS THAT RESULT IN UPWELLING OFF OREGON M.S. Thesis
Jeffrey Dale Hawkins Feb. 1979 86 p refs
(Grants NSF ATM-77-02520; NSF OCE-77-27735)
(PB-301240/8; FSU-MET-STU-79-1; NSF/IDOE-79-59; NSF/IDOE/CUEA/TR-52) Avail: NTIS HC A05/MF A01 CSCL 04B

The lower atmospheric structural variations along Oregon's central coast are studied before and during an upwelling event. The effect of these fluctuations on the surface ocean layer are documented. A vast array of meteorological and oceanographic observations were taken by aircraft, pilot balloons, rawinsondes, buoys, land stations, and ships during the Coastal Upwelling Experiment 1 in the summer of 1972. The winds, currents, air and water temperatures from the surface ocean layer to 1.5 km

are compared for a weak-long period of southerly winds followed by a similar period with northwesterly winds. GRA

N80-15769# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
***APPLICATION OF A TWO-DIMENSIONAL CLOUD MODEL* TO CLOUD SEEDING EXPERIMENTS Final Report, 1 Jul. 1975 - 31 Jan. 1979**
Harold D. Orville, Richard D. Farley, Fred J. Kopp, John H. Hirsch, and Eith-Yu Hsie Apr. 1979 99 p
(Contract DI-S-07-DR-12100)
(PB-299997/8; Rept-79-4) Avail: NTIS HC A05/MF A01 CSCL 04B

A two dimensional, time dependent cloud model was *compared with observations and used to simulate cloud seeding* experiments. The model is a set of partial differential equations that expresses conservation of momentum, energy, air mass, *and various water masses, such as rain, hail, cloud water, and* cloud ice. The model was run with atmospheric soundings from Miles City, Montana, and Big Spring, Texas, and shows *quantitatively the difference in precipitation processes between* the two sites. Both dry ice and silver iodide seeding techniques were tested. A first generation model in which the dry ice *seeding is assumed to effect directly an increase in precipitating* ice and a second generation seeding model in which a seeding agent field is traced throughout the model and interacts with *the supercooled cloud water to form cloud ice are examined.* GRA

N80-15770# Washington Univ., Seattle. Cloud Physics Group.
***AIRBORNE STUDIES OF ATMOSPHERIC AEROSOL IN THE* HIGH PLAINS AND THE STRUCTURES OF NATURAL AND ARTIFICIALLY SEEDED CLOUDS IN EASTERN MONTANA**
Final Report, Jun. 1976 - Sep. 1978
Peter V. Hobbs, Marcia K. Politovich, David A. Bowdle, and Lawrence F. Radke Dec. 1978 424 p refs
(Contract DI-S-07-DR-20110)
(PB-299026/5; Cloud-Physics-Research-13; Rept-1) Avail: NTIS HC A18/MF A01 CSCL 04B

A study is described of atmospheric aerosol over the High Plains of the United States, and of cloud structures, precipitation-producing mechanisms, and the potential for precipitation *modification by various types of cloud seeding in SE Montana.* Frequency distributions of cloud condensation nucleus (CCN) concentrations are represented by the superposition of two *log-normal distributions. CCN concentrations varied cyclically over* several days between low concentrations near widespread rain and high concentrations in dry weather. During these variations, CCN concentrations at high supersaturations were similar to dry weather values while concentrations at low supersaturations were *similar to rainy weather values.* GRA

N80-15771# National Center for Atmospheric Research, Boulder, Colo. Convective Storms Div.
***TECHNIQUES EMPLOYED IN THE PROCESSING OF* PARTICLE SIZE SPECTRA AND STATE PARAMETER DATA OBTAINED WITH THE T-28 AIRCRAFT PLATFORM**
Andrew J. Heymsfield and Joanne L. Parrish May 1979 89 p refs
(Grant NSF ATM-77-23757)
(PB-299362/4; NCAR-TN-137+1A) Avail: NTIS HC A05/MF A01

Computer software was developed to process particle size spectrometer and thermodynamic data obtained with the T-28 hail research aircraft. Five computer programs were developed to optimize the data reduction techniques. Program one reduces the standard meteorological data and presented 2D images. Program two is used to plot the standard meteorological data. Program three is used for reducing and plotting particle size spectra measurements, and in deriving microphysical parameters. Program four is used to derive the liquid water depletion time constants, dBZ growth rate, ice particle temperature, and sedimentation velocities within the updraft. Program five is used to derive the microphysical parameters from a programmable calculator. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; *and marine resources.*

N80-15772# Environmental Data and Information Service, Washington, D. C.
***INTERNATIONAL DECADE OF OCEAN EXPLORATION*, VOLUME 7 Progress Report, Apr. 1977 - Apr. 1978**
Oct. 1978 108 p refs
(NOAA-S/T-78-211-Vol-7) Avail: NTIS MF A01; SOD HC

A number of programs concerned with the use of the ocean and it's resources are presented. Specific programs dealing with *environmental quality, improving environmental forecasting,* expanding sea bed assessment activities, and developing an ocean monitoring system are described. Information, data inventories, *and lists of scientific reports derived from U.S. IDOE projects* are presented. A.W.H.

N80-15773# Brookhaven National Lab., Upton, N. Y.
CORRELATION BETWEEN WAVE SLOPES AND NEAR-SURFACE OCEAN CURRENTS
S. SethuRaman 1978 12 p refs *Presented at the 10th* Colloq. on Ocean Hydrodyn., Liege, May 1978
(Contract EY-76-C-02-0016)
(BNL-25068; CONF-7805132-1) Avail: NTIS HC A02/MF A01

The development of wind generated currents in the ocean *was studied with simultaneous observations of mean wind speed,* wind directions, surface wave parameters, and near surface ocean current. A high correlation between wave slope and near surface *current which indicates the possibility of wave age playing a* significant role in the generation of current is discussed. The wind generated current found to have a broad spectral peak as *compared with tidal currents and found to occur at approximately* the same frequency as wind speed spectral peak is described. DOE

N80-15774# Skidaway Inst. of Oceanography, Savannah, Ga.
TRACE ELEMENT GEOCHEMISTRY OF THE SOUTH *ATLANTIC BIGHT* Progress Report
H. L. Windom and C. T. Wallace 2 Mar. 1979 25 p refs
(Contract EY-76-S-09-0890)
(DOE/EV-00890-3) Avail: NTIS HC A02/MF A01

The role of frontal zones in the nearshore region on trace element transport and dispersion and the role of particulate matter in the geochemistry of trace elements in the South Atlantic Bight were investigated along with instrusion source water trace element characteristics. It was found that the concentration of both particulate and total trace metals decreases sharply across the nearshore front, and rapidly approaches values found in *oligotrophic open ocean surface waters. Compositional analysis* of the particulate phase when combined with total metal analysis suggests that Cu may preferentially associate with particulate organic matter, even in the clay-mineral-rich, turbid nearshore zone. DOE

N80-15775# Woods Hole Oceanographic Institution, Mass.
ANALYSIS AND INTERPRETATION OF TIDAL CURRENTS IN THE COASTAL BOUNDARY LAYER Ph.D. Thesis - MIT, Cambridge
Paul Wesley May Jul. 1979 203 p refs
(Contract DE-AC02-79EV-10005)
(PB-299428/3; WHOI-79-59) Avail: NTIS HC A10/MF A01 CSCL 08C

The coastal boundary layer transect experiment was conducted within 12 km of the south shore of Long Island, New York, to elucidate the characteristics of the coastal boundary layer in the Middle Atlantic Bight. Data from this experiment show that 35 percent of the kinetic energy of currents averaged over the 30 m depth are due to the semidiurnal and diurnal tides. Tidal ellipses show considerable vertical structure which can be explained adequately by a local constant eddy viscosity model with a slippery bottom boundary condition. Internal oscillations of tidal frequency also occur in the data. These are primarily at diurnal frequencies and may be Doppler-shifted by the mean currents of the coastal region. GRA

N80-15776# National Marine Fisheries Service, Seattle, Wash.
SURFACE CIRCULATION IN THE NORTHWESTERN GULF OF MEXICO AS DEDUCED FROM DRIFT BOTTLES
Robert F. Temple and John A. Martin May 1979 22 p refs
(PB-299078/6; NOAA-TR-NMFS-SSRF-730; NOAA-79071102) Avail: NTIS HC A02/MF A01 CSCL 08C

Of the total 7,863 drift bottles released at predetermined stations in the northwestern Gulf of Mexico, 12 percent (953) were recovered within 30 days after release. Analysis of the monthly recoveries revealed seasonal shifts in the flow of surface waters. Between September and February the dominant flow was west along the Louisiana and east Texas coasts, shifting southwest along the southern Texas coast. Between March and May, currents underwent a transitional period, shifting to the north and onshore, particularly along the south and central Texas coast. Converging currents, also apparent along the south Texas coast, appeared to progress up the coast with time. In June and July the surface flow was to the northeast and east. August was another transitional period with currents appearing to weaken and turning on-shore. Movements of surface waters appeared directly related to prevailing winds. GRA

N80-15777# Washington Univ., Seattle. Dept. of Oceanography.
FAR-FIELD MATCHING FOR TIDAL CALCULATIONS IN NEARSHORE REGIONS
Carl Pearson Feb 1979 41 p refs
(Grants NOAA-04-7-158-44021; NSF OCE-76-00406)
(PB-299016/6; WSG-79-1; Contrib-1061; NOAA-79070205) Avail: NTIS HC A03/MF A01 CSCL 08C

Tidal current calculations in bays and estuaries show that the solution is sensitive to the tidal boundary condition imposed at the mouth of the bay. The difficulty is resolved by replacing the boundary condition at the mouth of the bay by a matching requirement between far-field and nearshore solutions; for tidal problems, such a procedure is complicated by the importance of the Coriolis term as well as by bathymetric and topographic complexities. A number of matching methods which can be used are described. These methods are based on integral equation, finite elements, variational methods, transform methods, series solution, or on a combination of such methods. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-15778*# National Aeronautics and Space Administration, Washington, D. C.
INFLUENCE OF HYPOKINESIS ON PHYSIOLOGICAL FUNCTIONS IN FOWL
J. Nvota, D. Lamosova, D. Tesarova, V. Cierna, and P. Vyboh Dec. 1979 14 p refs Transl. into ENGLISH from Vet. Med. (Prague), v. 22, no. 7, 1977 p 425-432 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75999) Avail: NTIS HC A02/MF A01 CSCL 06B

The effects of hypokinesis and postincubation stress (which are characteristic for modern techniques of poultry cage keeping) on the endocrine functions, metabolic reactions, body weight growth and proteosynthesis in the muscle of cocks was investigated. The stress due to hypokinesis was observed in growing cocks housed in metallic cages in which they could hardly turn around. The findings obtained indicate that a 35-day hypokinesis did not exert any more significant influence both on physiological functions and body weight growth as well as on proteosynthesis in the muscle of cocks under study; however, it speeded up the protein metabolism in the muscle. The postincubation stress modified significantly the hypokinesis effect. Findings recorded in birds differed considerably from findings obtained in laboratory mammals, in which the hypokinesis induced significant changes in endocrine functions, body weight decrease and proteosynthesis disorders. A good tolerance of hypokinesis by fowl can be interpreted not only by the phylogenetic remoteness of the compared species but also by the domestication. R.E.S.

N80-15779*# National Aeronautics and Space Administration, Washington, D. C.
***THE COURSE OF EXPERIMENTAL STAPHYLOCOCCUS* INFECTION IN ALBINO MICE DURING ACTION OF CERTAIN FACTORS OF SPACE FLIGHT**
V. Ya. Prokhorov, V. M. Shilov, and E. A. Borman Jan. 1980 8 p refs Transl. into ENGLISH from Zh. Mikrobiol., Epidemiol. i Immunol. (USSR), v. 47, no. 11, 1970 p 82-86 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75973) Avail: NTIS HC A02/MF A01 CSCL 06C

A study was made of the effect of certain factors of space flight, acceleration and hypokinesia, on the course of experimental staphylococcus infection in mice. Combined action of hypokinesia and acceleration caused a marked depression of the phagocytic activity of leukocytes and formation of a considerable amount of alpha toxin. Author

N80-15780*# National Aeronautics and Space Administration, Washington, D. C.
EVOKED POTENTIALS IN IMMOBILIZED CATS TO A COMBINATION OF CLICKS WITH PAINFUL ELECTROCUTANEOUS STIMULI
M. A. Gilinskiy and I. A. Korsakov Nov. 1979 18 p refs Transl. into ENGLISH from Zh. Vyssh. Nerv. Deyatel. (Moscow), v. 23, no. 4, 1973 p 855-863 Transl. by Scientific Translation Service, Box 5456, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75941) Avail: NTIS HC A02/MF A01 CSCL 06C

Averaged evoked potentials in the auditory, somatosensory, and motor cortical zones, as well as in the mesencephalic reticular formation were recorded in acute experiments on nonanesthetized, immobilized cats. Omission of the painful stimulus after a number of pairings resulted in the appearance of a delayed evoked potential, often resembling the late phases of the response to the painful stimulus. The characteristics of this response are discussed in comparison with conditioned changes of the sensory potential amplitudes. K.L.

N80-15781*# National Aeronautics and Space Administration, Washington, D. C.
ACTIVITY OF CHOLINESTERASES OF BLOOD AND HEART IN RATS OF DIFFERENT SEX AND AGE DURING MUSCULAR LOADS AND HYPOKINESIA
V. D. Rozanova and G. A. Antonova Dec. 1979 14 p refs Transl. into ENGLISH from Fiziolhk. Zh. SSSR (USSR), v. 64, no. 7, 1978 p 999-1003 Transl. by Scientific Translation Service, Box 5456, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75951) Avail: NTIS HC A02/MF A01 CSCL 06C

The activity of acetylcholinesterase (Ache) and butyrilcholinesterase (Bche) in the blood and the heart of 3 and 13 month old control male rats is considerably lower than in female rats. In 25 month old rats, no sex differences in the Ache and Bche were revealed in the heart. In 3 and 13 month old male and female rats, under conditions of muscular exercises, the Ache and Bche activity is lower, and in hypokinetic male rats -- higher than that in respective control animals. In all the rats, irrespective of sex, age, and motor conditions, Ache and Bche activity tended to decrease from the sinoatrial node to the heart apex. Author

N80-15782*# National Aeronautics and Space Administration, Washington, D. C.
RAT REACTION TO HYPOKINESIA AFTER PRIOR ADAPTATION TO HYPOXIA
Z. I. Barashova and O. I. Tarakanova Jan. 1980 13 p refs Transl. into ENGLISH from Fiziolhk. Zh. SSSR (USSR), v. 15, no. 3, 1974 p 434-439 Original language document previously announced as A74-31091 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75964) Avail: NTIS HC A02/MF A01 CSCL 06C

The effect of prior hypoxia adaptation on body tolerance to hypokinesia was investigated. Rats trained to a 50 day period

of hypokinesia and hypoxia with a preliminary month of adaptation to hypoxia showed less weight loss, higher indices for red blood content, heightened reactivity of the overall organism and the central nervous system to acute hypoxia, and decreased modification of the skeletal muscles compared to rats subjected to hypokinesia alone. K.L.

N80-15783*# National Aeronautics and Space Administration, Washington, D. C.
STUDY ON THE NEURONAL CIRCUITS IMPLICATED IN POSTURAL TREMOR AND HYPOKINESIA
L. J. Poirier (Canadian Med. Res. Council), G. Bouvier (Canadian Med. Res. Council), P. Bedard (Canadian Med. Res. Council), R. Boucher (Canadian Med. Res. Council), L. Larochelle (Canadian Med. Res. Council), A. Oliver (Canadian Med. Res. Council), and P. Singh (Laval Univ.) Jan. 1980 43 p refs Transl. into ENGLISH from Rev. Neurol. (Paris), v. 120, no. 1, 1969 p 15-40 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76004) Avail: NTIS HC A03/MF A01 CSCL 06C

The effect of various tegmentary lesions at the level of the pontomesenchphalon in monkeys on motor function was observed. The importance of the monoaminergic mechanisms of the brainstem is discussed. The results also show the importance of the descending tegmentary rubral system and the rubroolivocerebellar circuit in controlling peripheral motor activity. The destruction of the sensory motor cortex proves to be a more effective way of eliminating spontaneous or harmaline induced tremor than the complete interruption of the pyramidal system on the level of the cerebral peduncle. Author

N80-15784# Argonne National Lab., Ill.
CHARGE SEPARATION IN SYNTHETIC PHOTO-REACTION CENTERS
J. J. Katz 1978 22 p refs Presented at the Workshop on Light-Induced Charge Separation at Interfaces in Biol. and Chem. Systems, West Berlin, 16 Oct. 1978
(Contract W-31-109-eng-38)
(CONF-781048-1) Avail: NTIS HC A02/MF A01

On the basis of electron paramagnetic resonance studies, there is good reason to suppose that the primary electron donor in plant and bacterial photo-reaction centers is a special pair of chlorophyll molecules. The donor-acceptor coordination interactions characteristics of chlorophyll are used to suggest a structure for the chlorophyll special pair. Chlorophyll special pairs with the suggested structure were prepared in the laboratory. These synthetic reaction centers mimic the essential features of P700 and P865 and provide a useful route to the study of electron transfer from in vivo photo-reaction centers. DOE

N80-15785# Rensselaer Polytechnic Inst., Troy, N. Y.
COMPARISON OF DIURNAL FLUCTUATIONS OF DISSOLVED INORGANIC CARBON AND ALGAL PRODUCTIVITY ESTIMATES IN AN OLIGOTROPHIC AND MESOTROPHIC FRESHWATER ENVIRONMENT
Paul A. Amodeo, Jr. and Nicholas L. Clesceri Jul. 1979 31 p refs
(Contract DI-14-34-0001-7172)
(PB-301201/0; OWRT-B-060-NY(1); W80-00002) Avail: NTIS HC A03/MF A01 CSCL 06C

Factors influencing the daily periodicity of algal carbon incorporation were investigated. Carbon, in the form of dissolved CO_2, is proposed as a major limiting nutrient in both an oligotropic and mesotrophic environment. A relationship between diurnal fluctuations of dissolved inorganic and algal carbon uptake was demonstrated by use of carbon-14 as a radio-carbon tracer. A possible correlation of the above fluctuations with the excretion of organic matter by algae is proposed. Work was conducted at Gull Bay, Lake George, New York and Willsboro Bay, Lake Champlain, New York. GRA

N80-15786# Utah State Univ., Logan. Utah Water Research Lab.
WASTE STABILIZATION LAGOON MICROORGANISM REMOVAL EFFICIENCY AND EFFLUENT DISINFECTION WITH CHLORINE Final Report, Aug. 1975 - Aug. 1976
Bruce A. Johnson, Jeffrey L. Wight, David S. Bowles, James H. Reynolds, and E. Joe Middlebrooks Jul. 1979 386 p refs
(Contract EPA-68-03-2151)
(PB-300631/9; EPA-600/2-79-018) Avail: NTIS HC A17/MF A01

The project objectives are to evaluate: (1) the amenability of algae-laden lagoon effluent to chlorine disinfection; and (2) the performance of a multi-cell lagoon system in removing coliform bacteria by natural means without the need for disinfection. Results indicate that adequate disinfection was obtained with combined chlorine residual within a contact period of 60 minutes. Filtered effluent was found to exert less chlorine demand than unfiltered. Temperature, sulfide, and total chemical oxygen demand were the most important factors affecting the chlorine dose necessary to achieve a specified bacteriological quality. A mathematical model was developed for use in selecting the optimal chlorine dosages needed for achieving prescribed levels of disinfection. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-15787* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 200
Dec. 1979 68 p
(NASA-SP-7011(200)) Avail: NTIS HC E03 CSCL 06E

This bibliography lists 204 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1979. Author

N80-15788*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
THE PHYSIOLOGICAL BASIS FOR SPACECRAFT ENVIRONMENTAL LIMITS
J. M. Waligora, comp. Washington Nov. 1979 229 p refs (NASA-RP-1045; S-487) Avail: NTIS HC A11/MF A01 CSCL 06K

Limits for operational environments are discussed in terms of acceptable physiological changes. The environmental factors considered are pressure, contaminants, temperature, acceleration, noise, rf radiation, and weightlessness. For individual titles, see N80-15789 through N80-15795.

N80-15789*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
ATMOSPHERE
D. J. Horrigan *In its* The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 1-15 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06K

The physiological basis of the limits established for atmospheric pressure as well as the partial pressures of oxygen, carbon dioxide, water vapor, and diluent gas are reviewed. K.L.

N80-15790*# Southwest Foundation for Research and Education, San Antonio, Tex.
CONTAMINANTS
H. L. Kaplan *In* NASA. Johnson Space Center The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 17-56 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06K

Spacecraft contaminants, their sources, and their toxicological effects are summarized. The problems of identifying toxic hazards, establishing standards for their concentrations, and designing removal systems are discussed. K.L.

N80-15791*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
THERMAL ENVIRONMENT
J. M. Waligora *In its* The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 57-69 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06K

The physiological effects, discomfort, and performance degradation associated with an imbalanced thermal environment are discussed. Temperature tolerance limits are set using thermoregulation models and experimental results. The effects of interacting environmental factors, individual variations, and exposure duration on tolerance limits are considered. K.L.

N80-15792*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PHYSICAL FORCES GENERATING ACCELERATION, VIBRATION, AND IMPACT
J. M. Waligora *In its* The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 71-107 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06K

The physiological effects of forces resulting in radial acceleration, sustained linear acceleration, impact, or vibration are identified. Tolerance limits are presented for these forces. K.L.

N80-15793*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SOUND AND NOISE
J. L. Homick *In its* The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 109-147 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06K

The effects of audible sound and noise, infrasound, and ultrasound on man are discussed. Those factors which have potential relevance to the space flight situation are emphasized. K.L.

N80-15794*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RADIOFREQUENCY RADIATION
D. S. Nachtwey *In its* The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 149-167 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06R

Sources, biophysical characteristics, and potential biological effects of rf radiation are described. Standards are given for exposure of spacecraft personnel to rf radiation. K.L.

N80-15795*# General Electric Co., Houston, Tex.
WEIGHTLESSNESS
D. J. Grounds *In* NASA. Johnson Space Center The Physiol. Basis for Spacecraft Environ. Limits Nov. 1979 p 169-185 refs (For primary document see N80-15788 06-52)
Avail: NTIS HC A11/MF A01 CSCL 06S

The general physiological effects of weightlessness are discussed with emphasis on the physiological effects that could limit mission durations in the absence of effective countermeasures. K.L.

N80-15796*# National Aeronautics and Space Administration, Washington, D. C.
JOINT SOVIET-AMERICAN EXPERIMENT ON HYPOKINESIA: EXPERIMENTAL RESULTS
N. N. Burovskiy Dec. 1979 320 p refs Transl. into ENGLISH of "Sovmestnyy Sovetsko-Amerikanskiy Eksperiment po Giopokinezii. Otchet. Rezul'taty Sovmestnogo Eksperimenta", USSR Acad. of Sci. and Ministry of Health, Moscow, Oct. 1979 p 1-372 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76013) Avail: NTIS HC A14/MF A01 CSCL 06S

Comprehensive results are reported from the Soviet portion of a joint Soviet-American experiment involving hypokinesia. The main emphases are on chemical analyses of blood and urine, functional tests, and examination of the cardiovascular system by electrocardiography, echocardiography, and plethysmography. Author

N80-15797*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF MEDICAL STUDIES DURING LONG-TERM MANNED FLIGHTS ON THE ORBITAL SALYUT-6 AND SOYUZ COMPLEX
A. D. Yegorov, comp. Nov. 1979 245 p refs Transl. into ENGLISH of "Rezultaty Meditsinskikh Issledovaniy vo Vremya Dlitel'nykh Pilotiruyemykh Polyetov na Orbital'nom Komplekse "Salyut-6--Soyuz"", USSR Acad. of Sci., Inst. of Med. and Biol. Problems, Moscow, 1979 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76014) Avail: NTIS HC A11/MF A01 CSCL 06P

Results of tests made on the crews of the Salyut-6 and Soyuz complex are presented. The basic results of studies made before, during and after 96-day and 140-day flights are presented in 5 sections: characteristics of flight conditions in the orbital complex; the cardiovascular system; the motor sphere and vestibular analyzer; biochemical, hematologic and immunologic studies; and recovery measures in the readaptation period. Author

N80-15798*# National Aeronautics and Space Administration, Washington, D. C.
CHANGES OF SOME BLOOD INDICES AND MYOCARDIAL ELECTROLYTE CONTENT DURING HYPOKINESIA
B. M. Fedorov, V. P. Krotov, and Ye. N. Zhuravleva Nov. 1979 12 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 6, Nov. - Dec. 1973 p 27-31 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75954) Avail: NTIS HC A02/MF A01 CSCL 06S

Using special hypokinetic cages, the volume changes of circulating blood, its hematocrit and protein content, volume ratios between extra- and intracellular liquids in the body, as well as electrolyte content in the blood and myocardium during hypokinesia were investigated experimentally in rabbits. R.E.S.

N80-15799*# National Aeronautics and Space Administration, Washington, D. C.
MECHANISM OF DISORDER OF PLASTIC PROCESSES IN TISSUE DURING PROLONGED HYPOKINESIA
G. A. Makarov Nov. 1979 11 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 4, Jul. - Aug. 1974 p 41-45 Transl. by Scientific Translation Service, Box 5456, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75955) Avail: NTIS HC A02/MF A01 CSCL 06S

The subcellular structures of the myocardium, skeletal muscles, liver and kidneys of adult rats subjected to hypokinesia (in immobilization chambers) for 15, 30, and 45 days were studied. An anabolyser (retabolil) and vitamin D (a Ca metabolism regulator) were administered to two groups of rats. On the second week of hypokinesia, inhibition of synthesis processes was observed. Administration of retabolil increased protein synthesis both in the normal and hypokinesia-subjected rats; however, in the latter group, synthesis did not completely normalize, especially in the myocardium. Administration of vitamin D also stimulated protein synthesis, apparently by normalizing Ca tissue metabolism. The combined action of both preparations was the most effective in normalizing protein synthesis intensity. It was concluded that inhibition of synthesis is related to weakening of hormone synthesis induction and disorder of Ca metabolism. Author

N80-15800# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
DAYTIME VISUAL ACUITY OF OBSERVERS THROUGH A WINDOW WITH AND WITHOUT BINOCULARS
Herschel C. Self and Steve A. Heckart Jul. 1979 23 p
(AF Proj. 7184)
(AD-A074722; AMRL-TR-79-23) Avail: NTIS HC A02/MF A01 CSCL 05/5

Visual acuity with and without hand-held M-19 7x50 binoculars was tested inside and outside the cab of a Master Surveillance Control Facility (MSCF) Tower. High, medium and low contrast 3 bar resolution test charts were used at a 400 foot distance. Except for low contrast bar patterns, where loss was not large, unaided eye visual acuity was not impaired by cab windows. With binoculars there was a statistically significant, though not large, window-caused loss of visual acuity for all contrasts. Even so, binocular visual acuity for high, medium and

low contrast patterns was 5.6, 5.5, and 4.8 times, respectively, better than unaided eye acuity. Recommendations for the MSCF, based on this study, were made. A section of the report examines visual considerations in fence surveillance. GRA

N80-15801# IIT Research Inst., Chicago, Ill.
BIOLOGICAL EFFECTS OF HIGH-VOLTAGE ELECTRIC FIELDS. AN UPDATE. VOLUME 2: BIBLIOGRAPHY Final Report
Jul. 1979 268 p refs Sponsored by Elec. Power Res. Inst. (EPRI Proj. 857-1)
(EPRI-EA-1123-Vol-2) Avail: NTIS HC A12/MF A01

Literature on the biological effects of power frequency electric fields are reviewed. The general findings of this update conclude that it is highly improbable that electric fields from transmission lines have significant biological effects on healthy individuals who encounter such fields in a normal way under ordinary conditions. However, further research is still needed in order to understand the nature and extent of any effects that could be harmful. DOE

N80-15802# California Univ., Berkeley. Lawrence Berkeley Lab.
SPECIAL SESSION ON VISION
F. S. Montalvo May 1979 13 p refs Presented at the ACM/SIGGraph 1979 Conf. on Computer Grahics and Interactive Techniques, Chicago, Aug. 1978
(Contract W-7405-eng-48)
(LBL-9160; CONF-780806-5) Avail: NTIS HC A02/MF A01

Some results of the visual structuring that occurs in the human visual system were demonstrated. It is shown why some features stand out instanteously and others do not. Knowledge of the human input device and its importance in structuring the design of effective computer output devices and displays is discussed. DOE

N80-15803# Gulf South Research Inst., New Orleans, La.
TOXIC POLYPEPTIDES AND UREMIA Final Progress Report, 1 Jun. 1978 - 31 May 1979
K. Ehrlich, E. Klein, F. F. Holland, Jr., and T. Turnham 2 Jul. 1979 47 p refs
(Contract N01-AM-8-2205)
(PB-301063/4; AK-1-8-2205F-79) Avail: NTIS HC A03/MF A01 CSCL 06C

Uremic serum ultrafiltrate was concentrated and fractionated on Bio-Gel P2 and Sephadex G15 columns. Sephadex fractions were tested for toxicity to human cells in culture. Fractions 1 and 2, containing peptide species with molecular weights greater than 700 daltons, inhibited 3H-thymidine uptake by HeLa and skin fibroblast cells more than the low molecular weight Sephadex material and an iso-osmolar control (saline). Fraction 2, containing molecules with molecular weights of angiotensin and vitamin B-12, inhibited 3H-thymidine incorporation the most (at 774 hours, the incorporation rate was only 2 percent of that of the control for one of the uremic ultrafiltrate concentrates). GRA

N80-15804# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
ELECTROMAGNETIC FIELDS IN BIOLOGICAL MEDIA. PART 2: THE SCAT PROGRAM, MULTILAYERED SPHERE, THEORY AND APPLICATIONS Final Report
Stanley M. Neuder Aug. 1979 30 p refs
(PB-300904/0; DHEW/PUB/FDA-79/8072; FDA/BRH-79/114) Avail: NTIS HC A02/MF A01 CSCL 06R

The theory and applications of a computer program, SCAT, for calculating the scattering and power absorption of radiofrequency and microwave radiation by spherical lossy dielectric bodies exposed to linearly polarized plane wave fields are described. The irradiated body may be a homogeneous sphere or multilayered, spherically concentric regions of arbitrary radii. Each region can be made to simulate biological tissue by assigning the appropriate dielectric properties. Induced fields and absorbed power density within these regions may then be calculated for preselected irradiation frequencies. Several applications of the SCAT program are described and associated computer plots are presented and discussed. GRA

N80-15805# Research Triangle Inst., Durham, N. C.
BIOLOGICAL SCREENING OF COMPLEX SAMPLES FROM INDUSTRIAL/ENERGY PROCESSES Progress Report, Sep. 1978 - Jul. 1979
Aug. 1979 24 p refs
(Contract EPA-68-02-2688)
(PB-300459/5; EPA-600/8-79-021) Avail: NTIS HC A02/MF A01 CSCL 06T

A biological screening program for complex samples from industrial and energy processes is described. Program elements and their application to various complex environmental samples are summarized. Results from the application of this program show that it is effective for screening complex mixtures. The data formating procedures used to report results from a diversity of biological tests in a meaningful way are also described. GRA

N80-15806# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
SLEEP, WAKEFULNESS AND CIRCADIAN RHYTHM
Sep. 1979 283 p refs Lectures held in London, 1-2 Oct. 1979, in Paris, 4-5 Oct. 1979, and in Toronto, 9-10 Oct. 1979
(AGARD-LS-105; ISBN-92-835-0249-3) Avail: NTIS HC A13/MF A01

Papers concerning the physiological and psychological aspects of sleep, and the adaptation of man to disturbed sleep are presented. The management of irregular rest and activity is also discussed. For individual titles, see N80-15807 through N80-15819.

N80-15807# Centre National de la Recherche Scientifique, Paris (France). Lab. de Physiologie
CIRCADIAN AND CIRCANNUAL RHYTHMS IN HEALTHY ADULTS
Alain Reinberg *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 13 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

Physiological processes in any living organism including man are not constant as a function of time: regular and predictable variations with period, tau, of about 24 hours (circadian), about 1 year (circannual) etc. can be detected. Each rhythm can be characterized by estimating such parameters as: acrophase theta (crest time), amplitude A and mesor M (rhythm adjusted mean). The estimation of tau, theta, A and M of a set of variables under specified experimental conditions enable the visualization of an aspect of the temporal organization (or biologic time structure). Aims of chronobiology are to quantify and investigate mechanisms of biological time structures. Biological rhythms and the related temporal organization are genetic in origin. However, one or several rhythm parameters may be influenced by cyclical variations of environmental factors (synchronizers or Zeitgeber). The latter has practical implications since phase shifts of synchronizers may occur with transmeridian flights, night-working and shift-working. Chronobiology also involves the study of rhythmic changes in endoctrine activities (chronoendocrinology) and in druys effects (chronopharmacology). F.O.S.

N80-15808# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. fuer Flugmedizin.
CIRCADIAN RHYTHMS OF HUMAN PERFORMANCE AND RESISTANCE: OPERATIONAL ASPECTS
Karl E. Klein and Hans-M. Wegmann *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 17 p refs Also presented at the 4th Ann. Sci. Meeting of the Aerospace Med. Assoc., Bal Harbour, Fla., 13 May 1976 (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

Circadian rhythmicity of mental and physical efficiency, and resistance to noxious hazards are reviewed. The interaction with internal and operational factors and implications are given for the management of human operations. The significance of the biorhythm concept for the prediction of human behavior, and the occurrence of man-related accidents are discussed. F.O.S.

N80-15809# Montefiore Hospital, New York. Dept. of Neurology.
SLEEP STAGE ORGANIZATION: NEURO ENDOCRINE RELATIONS

Elliot D. Weitzman *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 9 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The circadian and shorter term episodic patterns of hormone systems are discussed. These include ACTH-cortisol; growth hormone (GH); prolactin; and the gonadotrophins, luteinizing hormone (LH); and follicle stimulation hormone (FSH). F.O.S.

N80-15810# Naval Health Research Center, San Diego, Calif.
SLEEP DISTURBANCES IN HUMANS
Laverne C. Johnson *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 16 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

Disturbed sleep results in feelings of fatigue and, usually, in impaired performance regardless of whether the disturbed sleep is due to excessive noise or a chronic sleep disorder. In addition to noise, some other environmental factors that disturb sleep are temperature, unscheduled operational demands that fragment sleep time, rotating shift-work schedules, and operational requirements that result in air travel across several time zones. While appropriate attention to sleep logistics may minimize the environmental causes of disturbed sleep, resolution of the disturbed sleep of those with sleep disorders is more difficult. The focus in sleep disorders must be on the individual. The major sleep complaint is insomnia, not enough sleep, usually due to prolonged sleep latency. A more serious medical problem, however, may be the complaint of excessive daytime sleep or hypersomnia. Most patients with complaints of hypersomnia are usually diagnosed as having narcolepsy or sleep apnea. Relative to narcolepsy, sleep apnea (episodes of respiratory arrest during sleep) has only recently received attention. In addition to a sleep problem, sleep apneic patients may have hypertension and/or cardiac arrhythmia. F.O.S.

N80-15811# Centre de Recherches du Service de Sante des Armees, Lyons (France).
VIGILANCE AND ATTENTION
M. Defayolle *In* AGARD Sleep, Wakefulness, and Circadian Rhythm Sep. 1979 13 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The relations between vigilance and attention are considered using computer, psychological and physiological techniques. After considering the different types of available measures, the factors influencing attention are reviewed. The characteristics of signals, the environmental conditions, the individual features and the possible interactions between these factors are then studied. The various theories are reviewed and a mathematical model is proposed which integrates activation, the use of processing ability and filtering, taking into consideration the data relative to the environment and to motivation. In conclusion, different methods are proposed from ergonomical, psychological and pharmacological viewpoints. F.O.S.

N80-15812# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.
BIOCHEMICAL INDICES OF STRESS: BIOCHEMICAL ASPECTS OF THE STRESS RESPONSE
Bryce O. Hartman and James P. Ellis *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 32 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The release of hormones in response to acute flight stresses was investigated in fighter pilots. The biochemical indices discussed include: hormones, hormone precursors, hormone metabolites, nonhormone metabolites, and enzymes of hormone formation/production. Abstracts and operational applications of previously published reports are presented. F.O.S.

N80-15813# Montefiore Hospital, New York. Human Chronophysiology Lab.
BIOLOGICAL RHYTHMS OF MAN LIVING IN ISOLATION FROM TIME CUES
Elliot D. Weitzman, Charles A. Czeisler, and Martin C. MooreEde *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 9 p refs Prepared in cooperation with Harvard Med. School (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The results are presented of prolonged measurements of sleep-waking functions in human subjects for periods of 25 to 105 calendar days in an environment free of all time cues. It was found that the biological rhythms of human beings free-run at periods greater than 24 hours, typically at approximately 25 hours. During free-running, the sleep to total time ratio remains constant, approximately 30. F.O.S.

N80-15814# Naval Health Research Center, San Diego, Calif.
SLEEP DISTURBANCE AND PERFORMANCE
Laverne C. Johnson *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 15 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

While the type of sleep obtained does not appear to be an important factor in performance, the time of day the sleep is obtained and when the performance occurs are very important. Time-of-day effects are a more crucial factor in performance than the preceding sleep patterns. The effect of total sleep loss becomes pronounced after 48 to 60 hours, consistent performance decrement following reduced sleep or fragmented sleep was not found. Feelings of fatigue, however, are a consistent finding in all sleep-loss studies. A significant relation between sleep quality (good vs. poor sleep) and performance is not easily found. The deleterious effect of hypersomnia, especially that due to narcolepsy is discussed. F.O.S.

N80-15815# Centre National de la Recherche Scientifique, Paris (France). Lab. de Physiologie.
TOLERANCE TO SHIFT WORK: A CHRONOLOGIC APPROACH
Alain Reinberg *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 11 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The hypotheses was tested of possible relationships between the amplitude A of the circadian rhythm of oral temperature on the speed of adjustment during shift work, and tolerance to shift work. Study 1 involved 25 oil refinery operators. A negative correlation ($r = -0.63$; P less than 0.01) was found between the mean A and the acrophase shift delta O resulting from the first night-shift: the larger the A, the smaller the delta O. Study 2 involved 23 steel industry workers and 25 chemical industry workers with either good or poor tolerance to shift work. Tolerance was evaluated conventionally according to 3 types of complaints: digestive troubles, persistant fatigue, sleep alterations. Circadian A of oral temperature is larger in subjects who tolerate to shift work than in intolerant subjects. The study 3 involved 29 oil refinery operators and was designed to retest both hypothesis, their complementarity and to take different age groups into account. Good tolerance to shift work, over many years, appears to be associated with a large circadian amplitude and a slow adjustment during night-shifts (small delta O). F.O.S.

N80-15816# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. fuer Flugmedizin.
CIRCADIAN RHYTHMS IN AIR OPERATIONS
Karl E. Klein and Hans-M. Wegmann *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 25 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

After a brief introduction into the principles of environmental and biological timing systems, the phenomenology of post-transmeridian de- and re-synchronization of circadian rhythms is presented, its control and modification through external and internal factors described, and the consequences for human efficiency and health discussed. There are conclusions drawn as to possible relief measures, formulas and models which define the physiological processes, and predict work loads occurring in transmeridian flight operations. Finally, the incorporation of circadian rhythm aspects into Rest/Duty Regulations is described. Author

N80-15817# Centre de Recherches du Service de Sante des Armees, Lyons (France).
PSYCHOSTIMULANTS
M. Defayolle *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 12 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The state-of-the-art of psychostimulants is reviewed, and a brief historical and geographical survey are presented. The basic neurochemical data on vigilance are considered and the various systems of mediators involved in synaptic conduction are differentiated. The methodology of therapeutic tests on psychotropes is then discussed. The effects induced by the use of the various types of drugs: noo-analeptics, nootropes, thymo-analeptics and metabolic adjuvants are considered. These data are incorporated into a general model of vigilance including the data handling capacity and filtering concepts. The indications and contraindications in the use of psychostimulants are presented. F.O.S.

N80-15818# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
HYPNOTICS AND THE MANAGEMENT OF DISTURBED SLEEP
A. N. Nicholson, R. G. Borland, and Barbara M. Stone *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 11 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

The effects of hypnotics on visuo-motor performance are discussed. The hypnotics studied include barbiturates, benzodiazepines, diazepam and its hyroxylated metabolites, and nordiazem. The effects of hypnotics on sleep are also discussed. F.O.S.

N80-15819# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.
MANAGEMENT OF IRREGULAR REST AND ACTIVITY
Bryce O. Hartman *In* AGARD Sleep, Wakefulness and Circadian Rhythm Sep. 1979 13 p refs (For primary document see N80-15806 06-52)
Avail: NTIS HC A13/MF A01

Biomedical aspects of the irregularity of air operations are discussed in terms of the requirements of aircrews to work without regards for the clock. In practice, operational managers consider the crew limitations and develop workable compromises between these limitations and mission requirements. That variables that must be considered are listed. Data collected from airlift missions are analyzed along with tactical operations. Sleep and the work-rest cycle during missions are discussed. F.O.S.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-15820# Los Alamos Scientific Lab., N. Mex.
MENTAL DYNAMICS
F. H. Harlow Jul. 1979 22 p
(Contract W-7405-eng-36)
(LA-7946-MS) Avail: NTIS HC A02/MF A01

The nonphysical life activity within an organism is described mathematically by means of a basic formulation to which numerous variations and embellishments are appended as required. The fundamental principle of overall activity normalization is presented and discussed in terms of its practical and philosophical consequences. Discrimination is introduced as a necessary complement to intelligence and creativity in the structure of genius. Future directions for development are described in terms of both deterministic and stochastic analysis for the organism as an isolated unit, as a member of society, and as an interacting element of the natural universe. DOE

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-15821*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME HUMAN FACTORS ISSUES IN THE DEVELOPMENT AND EVALUATION OF COCKPIT ALERTING AND WARNING SYSTEMS
Robert J. Randle, Jr., William E. Larsen, and Douglas H. Williams Washington Jan. 1980 65 p refs
(NASA-RP-1055; A-7696) Avail: NTIS HC A04/MF A01 CSCL 05H

A set of general guidelines for evaluating a newly developed cockpit alerting and warning system in terms of human factors issues are provided. Although the discussion centers around a general methodology, it is made specifically to the issues involved in alerting systems. An overall statement of the current operational problem is presented. Human factors problems with reference to existing alerting and warning systems are described. The methodology for proceeding through system development to system test is discussed. The differences between traditional human factors laboratory evaluations and those required for evaluation of complex man-machine systems under development are emphasized. Performance evaluation in the alerting and warning subsystem using a hypothetical sample system is explained. R.C.T.

N80-15822*# National Aeronautics and Space Administration, Washington, D. C.
MODEL TASK FOR THE DYNAMICS OF AN UNDERWATER TWO-LEGGED WALKER
V. V. Beletskiy, V. V. Golubkov, and Ye. A. Stepanova Nov. 1979 49 p refs Transl. into ENGLISH of "Modelnaya Zadacha Dinamiki Podovnoy Dvunogoy Khodby", Rept. Preprint-42 Acad. of Sci. USSR, Inst. of Appl. Math., Moscow, 1979 p 1-58 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75697; Preprint-42) Avail: NTIS HC A03/MF A01 CSCL 05H

A model task of two-legged underwater walking was examined. Characteristics of the walking were established. The underwater walking device is a substantial sphere, which moves on dual-member legs. The dynamics of the device were investigated with the calculation of the buoyancy of Archimedes, and the force of hydrodynamic resistance. R.E.S.

N80-15823# Perceptronics, Inc., Woodland Hills, Calif.
MAN-MACHINE COMMUNICATION IN COMPUTER-AIDED REMOTE MANIPULATION Progress Report, 2 Feb. 1978 - 1 Feb. 1979
William H. Crooks, Efraim Shaket, Yee-Yeen Chu, and Yoram Alperovitch Mar. 1979 167 p refs
(Contract N00014-76-C-0603)
(AD-A074566; PATR-1034-79-3) Avail: NTIS HC A08/MF A01 CSCL 05/8

Automated Remote Manipulation is a prime example of a new type of man-machine interaction in which the human operator must supervise and control a complex and often adaptive man-computer system. Computerized control offers the possibilities of improved performance times and reduced operator workloads with teleoperator systems. Computers can be used at various levels of control, ranging from control augmentation, where the computer performs difficult coordinate transformations which simplify operator control requirements, through complete autonomy in which the computer performs all of the required activities with no intervention by the operator. However, with the introduction of computer-based control techniques, the communication between the operator and the teleoperator becomes an important determinant of work system performance. Rather than controlling directly every action of the manipulator, the operator of a computer-controlled manipulator plans the tasks, commands goal-directed actions, monitors task performance, and intervenes when appropriate. This report describes an analytical and experimental study to investigate the effective-

ness of command language structures and the methods for providing feedback information through the use of sensors and displays. GRA

N80-15824# Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.
TELEOPERATORS UNDER THE SEA
Norman Doelling 1 Jul. 1979 26 p refs
(PB-299883/9; MITSG-79-15; Opportunity-Brief-14; NOAA-79080909; Index-79-715-MOT) Avail: NTIS HC A03/MF A01 CSCL 13J

Research projects being carried out to design, develop, test and extend the capabilities of undersea vehicles are described. The projects relate primarily to untethered, unmanned vehicles, in part because such vehicles offer the greatest challenge and in - part because solution to the difficult problems associated with such systems will have useful applications in tethered and/or manned systems now being developed, built, and used. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-15825*# General Electric Co., Huntsville, Ala. Space Div.
DATA BASE MANAGEMENT SYSTEM CONFIGURATION SPECIFICATION
James W. Neiers Oct. 1979 111 p
(Contract NAS8-33374)
(NASA-CR-161351; Rept-79HV013) Avail: NTIS HC A06/MF A01 CSCL 09B

The functional requirements and the configuration of the data base management system are described. Techniques and technology which will enable more efficient and timely transfer of useful data from the sensor to the user, extraction of information by the user, and exchange of information among the users are demonstrated. R.C.T.

N80-15826# Naval Underwater Systems Center, New London, Conn. New London Lab.
PERFORMANCE AND TIMELINESS IN A DATABASE
Lynn A. DeNoia 3 Jul. 1979 232 p refs
(ZF61112001)
(AD-A074552; NUSC-TR-6099) Avail: NTIS HC A11/MF A01 CSCL 05/2

A methodology is presented for evaluating the system cost/performance of alternative approaches to distributed database management. For each type of database transaction, the management schemes are analyzed to identify the specific control paths and data flow requirements. Then the control and data flow information is used to develop a queueing network model of the entire system. Specific cost/performance analyses can be made when assumptions about particular operating characteristics (such as communication delays, processor power, and disk rates) are incorporated into the model. Average system response time and average network traffic are computed for four management approaches: centralized, a master/slave scheme, a sychronized scheme, and a new scheme called delayed synchronization. The new scheme is based on daily operation without synchronizing updates, supported by nightly merging to produce identical data copies throughout the system. Timeliness information is associated with every individual data item and users are given a choice in retrieval transactions between quick response and most recently updated values. GRA

N80-15827# Maryland Univ., College Park. Dept. of Information Systems Management.
DATA MODEL PROCESSING: AN APPROACH TO STANDARDIZATION OF DATABASE MANAGEMENT SYSTEMS Technical Report, 1 Sep. 1978 - 25 Jul. 1979
W. Terry Hardgrave and Edgar H. Sibley 27 Jul. 1979 27 p refs
(Grant DAAG29-78-G-0162)
(AD-A074601; IFSM-TR-45; ARO-15712.3-A-EL) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper outlines a general philosophy and framework for the specification of a data model. Extracts from scenarios that have been developed for specification of several well-known data models (e.g., DBTG, relational, TDMS) are given and discussed. These extracts are preliminary and incomplete, but they are used to illustrate the feasibility of the Data Model Processor Approach. The scenarios are intended for implementation of an augmented positional processor that will be able to support different data models and, through transformation, serve in defining and testing new DBMS standards. GRA

N80-15828# Naval Postgraduate School, Monterey, Calif.
DISTRIBUTED, SECURE DESIGN FOR A MULTI-MICROPROCESSOR OPERATING SYSTEM M.S. Thesis
James Steven OConnell and Larry Don Richardson Jun. 1979 90 p refs
(AD-A073923) Avail: NTIS HC A05/MF A01 CSCL 09/2

This thesis applies the state of the art techniques for methodical design of secure operating systems to a distributed, multi-microprocessor environment. Explicit process structure and utilization of virtual environments are the fundamental concepts that form a basis for the design presented. The primary design techniques utilized in the design are segmentation, distributed operating system, security kernel, multiprocessing, 'cache' memory strategy and multiprogramming. The resulting design is for a family of distributud operating systems that can provide the power of yesterday's large computer in a microprocessor environment. Security, configuration independence, and a loop free structure are the primary characteristics of the design. The design, although hardware independent, was formulated with the Zilog Z8000 or a similar microprocessor in mind. GRA

N80-15829# Naval Postgraduate School, Monterey, Calif.
THE DESIGN AND IMPLEMENTATION OF AN INEXPENSIVE MICROPROCESSOR DEVELOPMENT SYSTEM FOR THE Z-80 MICROPROCESSOR M.S. Thesis
Douglas Floyd Corteville Jun. 1979 103 p refs
(AD-A073927) Avail: NTIS HC A06/MF A01 CSCL 09/2

The Radio Shack home computer system, TPS-80, configured with Level II Basic ROM's, 16K of RAM, its expansion interface, a single disk drive, and a line printer interface to the TELETYPE model 40 line printer is being used as a microprocessor development aid for the Z-80 microprocessor. Basic language programs are resident on the mini-disk and are used to load, to store, to dump, and to execute assembled assembly language programs. GRA

N80-15830# International Computer Co., Bethesda, Md.
VTS PROCESSING DISPLAY SUBSYSTEM DESIGN Final Report, Apr. 1978 - Jan. 1979
C. C. Henson, F. T. Mickey, R. S. Graham, and B. A. McIntosh Jan. 1979 308 p refs

(Contract DOT-CG-81-78-1833)
(AD-A074053; USCG-D-54-79; CGR/DC-13/79) Avail: NTIS HC A14/MF A01 CSCL 09/2

A distributed function, multiple bus coupled minicomputer system architecture will be used for the Vessel Traffic Services (VTS) Processing/Display Subsystem. Four critical issues are examined including: Reliability; Programming Language Selection; Interprocessor Bus Design; and Multicomputer Operating System Design. System availability requirements can be met with partial redundancy with software controlled reconfiguration and recovery based on both hardware and software error and failure detection. PASCAL is the best programming language available for VTS. A relatively low cost interprocessor bus capable of transmitting at 1.5 megabits per second can be built using off-the-shelf LSI components. The VTS operating system will feature explicit message and answer communications between processes for interprocess communication and synchronization. Error detection and reporting and system reconfiguration and recovery will be controlled by the operating system. The top level of the software design is structured as a group of cooperating sequential processes which use the operating system facility for interprocess communication and synchronization, providing flexibility in assigning processes to processors. Hardware configurations are developed for three possible combinations of functional and traffic handling capabilities. Hardware requirements are included for processors, buses, discs, tapes, graphics units, CRTs, printers, and keyboards. GRA

N80-15831# Stanford Linear Accelerator Center, Calif.
ASPECTS OF COMPUTER CONTROL FROM THE HUMAN ENGINEERING STANDPOINT
T. V. Huang Mar. 1979 4 p refs Presented at the Intern. Colloq. on Circuit and Systems, Taipei, Taiwan, 23 Jul. 1979
(Contracts DE-AC03-76SF-00515)
(SLAC-PUB-2307; CONF-790717-1) Avail: NTIS HC A02/MF A01

A Computer Control System includes data acquisition, information display and output control signals. In order to design such a system effectively the required operational mode: automatic control (closed loop), computer assisted (open loop), or hybrid control are determined. The choice of operating mode will depend on the nature of the plant, the complexity of the operation, the funds available, and the technical expertise of the operating staff, among many other factors. Once the mode has been selected, consideration must be given to the method (man/machine interface) by which the operator interacts with this system. The human engineering factors are of prime importance to achieving high operating efficiency and very careful attention must be given to this aspect of the work if full operator acceptance is to be achieved. These topics are discussed along with the experience gained in setting up the computer control system in Main Control Center for Stanford University's Accelerator Center (a high energy physics research facility). In this complex system both open and closed loop computer controls are used, as well as large numbers of manual functions. DOE

N80-15832# National Technical Information Service, Springfield, Va.
MINICOMPUTERS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1975 - Aug. 1979
Brian Carrigan Sep. 1979 290 p Supersedes NTIS/PS-78/0935; NTIS/PS-77/0755; NTIS/PS-76/0673; NTIS/PS-75/572; NTIS/PS-74/102
(NTIS/PS-79/0978/1; NTIS/PS-78/0935; NTIS/PS-77/0755; NTIS/PS-76/0673; NTIS/PS-75/572; NTIS/PS-74/102) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Reports on the design and applications of minicomputers are presented. A few of the areas of application include audio recorders, chemical analysis, radiation detection, process control, reactor control, production control, ocean sciences, and tracking systems. Supporting software for solving the problems and processing the data in the many areas of application are included. This updated bibliography contains 283 abstracts, 54 of which are new entries to the previous edition. GRA

N80-15833# National Bureau of Standards, Washington, D.C. Inst. for Computer Science and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: COMPUTER PERFORMANCE EVALUATION USERS GROUP (CPEUG), 15TH Final Report
James E. Weatherbee Oct. 1979 244 p refs Meeting held at San Diego, Calif., 15-18 Oct. 1979
(PB-300468/6; NBS-SP-500-52) Avail: NTIS HC A11/MF A01 CSCL 09B

Changes in CPE techniques that will occur in an era of increased use of distributed processing techniques are discussed. Specific topics covered include application of CPE in installation management, and methods and tools of CPE as a technical discipline. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-15834# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
SEMI-ANALYTICAL FORMULAE FOR REAL-TIME IMPLEMENTATION OF OPTIMAL MISSILE AVOIDANCE STRATEGIES
Y. Rotsztein and J. Shinar Dec. 1978 31 p refs
(Grant AF-AFOSR-3458-77)
(TAE-352) Avail: NTIS HC A03/MF A01

Approximated formulae for the optimal evasive maneuver sequence and the resulting miss distance are presented. These formulae are useful for the analysis of missile performance against optimally-evading targets. Their most appealing application is for real-time airborne implementation of optimal missile avoidance strategies. F.O.S.

N80-15835# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
A DIFFERENTIAL DYNAMIC PROGRAMMING ALGORITHM FOR THE SOLUTION OF THE THREE-DIMENSIONAL OPTIMAL MISSILE AVOIDANCE
J. Shinar and D. Blank Nov. 1978 35 p refs
(Grant AF-AFOSR-3458-77)
(TAE-351) Avail: NTIS HC A03/MF A01

A first order differential dynamic programming algorithm is applied to the numerical solution of the three dimensional optimal evasion with linearized kinematics. The results obtained show that the first order algorithm solves the problem in a small number of iterations even for poorly guessed initial controls. K.L.

N80-15836*# TRW Defense and Space Systems Group, Houston, Tex.
DETAILED DESCRIPTION OF THE HP-9825A HFRMP TRAJECTORY PROCESSOR (TRAJ)
S. M. Kindall and S. W. Wilson 20 Nov. 1979 278 p refs
(Contract NAS9-14723)
(NASA-CR-160440; TRW-28415-H011-RO-00) Avail: NTIS HC A13/MF A01 CSCL 09B

The computer code for the trajectory processor of the HP-9825A High Fidelity Relative Motion Program is described in detail. The processor is a 12-degrees-of-freedom trajectory integrator which can be used to generate digital and graphical data describing the relative motion of the Space Shuttle Orbiter and a free-flying cylindrical payload. Coding standards and flow charts are given and the computational logic is discussed. K.L.

N80-15837*# National Aeronautics and Space Administration, Washington, D.C.
PROBLEMS IN PROCESSING MULTIZONAL VIDEO INFORMATION AT SPECIALIZED COMPLEXES
V. A. Shamis Dec. 1979 12 p Transl. into ENGLISH of "Voprosy Obrabotki Mnogozonal'noy Video Informatsii na Spetsializirovannykh Kompleksakh", Rept. Pr-345 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-14 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75919; Pr-345) Avail: NTIS HC A02/MF A01 CSCL 09B

Architectural requirements of a minicomputer-based special-

ized complex for automated digital analysis of multizonal video data are examined. The logic structure of multizonal video data and the complex mathematical provision required for the analysis of such data are described. The composition of the specialized complex, its operating system, and the required set of peripheral devices are discussed. It is noted that although much of the analysis can be automated, the operator-computer dialog mode is essential for certain stages of the analysis. K.L.

N80-15838# ARO, Inc., Arnold Air Force Station, Tenn.
SOFTWARE TECHNIQUES FOR THE ACQUISITION OF OPTICAL DATA FROM A MINICOMPUTER-BASED IMAGE-INTENSIFIER-VIDICON SYSTEM Final Report, 1 Mar. - 31 Oct. 1978
J. H. Jones Arnold AFS AEDC Sep. 1979 87 p refs
(AD-A074844; AEDC-TR-79-43) Avail: NTIS HC A05/MF A01 CSCL 09/5

The software required to support a new technique for acquiring large amounts of optical data in a short time period has been developed. The data acquisition system incorporates an image intensifier and vidicon tube in combination. It is controlled by a minicomputer utilizing the software described. The software handles all control of the image-intensifier-vidicon system, acquires the data from the system, and stores the data for subsequent retrieval and reduction. The software incorporates a disk operating system for a single floppy disk drive. This disk operating system utilizes a specially designed technique that optimizes the rate of writing data onto the disk. The system was implemented to acquire temperature and density data from the flow of a rocket engine exhaust plume. This application coupled the system with an electron beam mechansim to acquire the data using and electron beam fluorescence technique. This application was used to verify that the system meets the requirements set forth for it. GRA

N80-15839# Stanford Univ., Calif. Stanford Electronics Lab.
DESIGN AND VERIFICATION OF RELIABLE SOFTWARE Annual Report, 1 Jan. - 31 Dec. 1978
Susan S. Owicki Jul. 1979 11 p refs
(Contract F49620-77-C-0045; AF Proj. 2304)
(AD-A074224; AFOSR-79-0978TR; AR-2) Avail: NTIS HC A02/MF A01 CSCL 05/2

This research project is concerned with methods for developing provably correct system programs. Two complementary approaches have been pursued. The first is the development of basic tools for describing and verifying concurrent programs; the aim is to find ways of managing the complexity which arises from concurrent interactions between system components. Specification and proof methods for invariant properties of modular programs have been developed. They allow independent verification of each module and provide a sufficient basis for reasoning about a wide class of concurrent systems. Tools for stating and verifying other types of requirements, e.g. that a message is eventually delivered, are in an earlier stage. Techniques have been designed that use temporal logic, a logical system that allows statements about future events. GRA

N80-15840# Military Academy, West Point, N. Y. Dept. of Earth Space and Graphic Services.
INTERACTIVE GRAPHIC TECHNIQUES FOR CONCEPTUAL ENGINEERING DESIGN Final Report
Glenn A. Porter 20 Apr. 1979 10 p refs Presented at the DECUS Conf., New Orleans, 17-20 Apr. 1979
(AD-A073837; USMA-ESGS-03) Avail: NTIS HC A02/MF A01 CSCL 09/2

Conceptual design is the initial and most creative phase of an engineering design project. The effective use of interactive computer graphics to enhance this design phase is dependent upon a highly developed interaction between the designer and the computer. This paper presents an analysis of the environment of conceptual design and proposes techniques for the creation of a successful man-machine interface which fosters the use of interactive computer graphics. GRA

N80-15841# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
PRIME AND PDQ SORTS: EFFICIENT MINIMAL STORAGE SORTING ALGORITHMS Final Report, Nov. 1978 - Mar. 1978
Roy R. Hilbrand Aug. 1979 63 p refs Prepared for the Joint Tech. Coordinating Group on Aircraft Survivability
(AD-A073567; JTCG/AS-78-V-004) Avail: NTIS HC A04/MF A01 CSCL 09/2

One of the problems involved in computer programs for vulnerability assessment is that of rapidly sorting and arranging large sets of data. Two sorting algorithms, designated PRIME and PDQ, have been developed at ASD to more efficiently perform this function in vulnerability programs such as SESTEM and FASTEGEN II. The results are compared to those obtained with three other algorithms, SHELLSORT, TREESORT3, and SINGLETON. The newly developed sorts are showed to be significantly faster on the ASD CDC 6600 computer than the existing sorts. When used in an ASD missile endgame model SESTEM, the average run time was reduced by 20 to 25%. Program listings, flow charts, and typical output data are presented. GRA

N80-15842# Honeywell Systems and Research Center, Minneapolis, Minn.
RATIONALE FOR THE DESIGN OF THE ADA PROGRAMMING LANGUAGE: VOLUME 14, NO. 6, PART B
Jean D. Ichbiah, Jean-Claude Heliard, Olivier Roubine, John G. P. Barnes, and Bernd Krieg-Brueckner Jun. 1979 268 p refs
(Contract MDA903-77-C-0331)
(AD-A073854) Avail: NTIS HC A12/MF A01 CSCL 09/2

This document, the rationale for the design of the Green programming language, and the companion Reference Manual, are the two defining documents for the Green language. They serve different purposes. The Reference Manual contains a complete and concise definition of the language. Following Wirth, we believe in the virtue of having a rather short reference manual. This has the advantage of providing the information in a form that can easily be consulted, read and reread several times, as the basis for developing a good familarity with the language. GRA

N80-15843# Alabama Univ., Huntsville. School of Science and Engineering.
AN ASSESSMENT OF SOFTWARE QUALITY ASSURANCE Final Report, 8 Jun. 1978 - 7 Jul. 1979
Pei Hsia and Frederick E. Petry Jul. 1979 24 p refs
(Contract DASG60-78-C-0088)
(AD-A074213) Avail: NTIS HC A02/MF A01 CSCL 09/2

This final report describes three tasks which can strengthen the Ballistic Missile Defense Systems Command overall research objectives in software systems development. The three tasks are: preprocessor for Verifiable PASCAL (V-PASCAL), evaluation of Software Quality Laboratory (SQLAB) tools and techniques, and testing research - a new approach. V-PASCAL is a language designed by GRC to extend PASCAL to permit experimentation with new language constructs which will aid in the development of BMD software. These capabilities can be implemented with a preprocessor which accepts an input source code written in V-PASCAL and generates standard PASCAL for compilation, or which extracts for verification purposes descriptive information about the source text. The feasibility of a preprocessor for V-PASCAL has been investigated, and a conclusion is that a revised design of the GRC produced V-PASCAL preprocessor will suffice for the present. GRA

N80-15844# Maryland Univ., College Park. Computer Science Center.
THE FLEX SYSTEM: USER AND CARETAKER'S MANUAL
Stephen A. Sutton Jun. 1979 79 p ref
(Grant AF-AFOSR-3181-77)
(AD-A073997; CSC-TR-765) Avail: NTIS HC A05/MF A01 CSCL 09/2

The FLEX Design System is a design language and its Processor that form a tool for use in computer software design activities. This report presents a detailed definition of the FLEX language, directions for using the Processor, and guidelines for installing, maintaining, and modifying the Processor software. GRA

N80-15845# Harry Diamond Labs., Adelphi, Md.
QINTEG: A PROGRAM FOR COMPUTING GAUSSIAN QUADRATURE COEFFICIENTS

Theodore H. Hopp Aug. 1979 35 p refs
(DA Proj. 1L1-61102-AH-44)
(AD-A073974; HDL-TR-1890) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report presents a program (QINTEG) to compute Gaussian quadrature coefficients for integration with respect to a weighting function. Discontinuities, singularities, or oscillatory behavior of integrands make many problems unsuited to numerical solution using existing general purpose integration programs. When the undesirable behavior of the integrand can be absorbed into the weighting function, numerical integration using the coefficients computed by QINTEG can be accomplished. Improvement of nearly two orders of magnitude in execution time over an existing program was achieved for a problem involving oscillatory integrands. A program listing is included. GRA

N80-15845# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
ADDITIONAL SOFTWARE DEVELOPMENTS FOR THE HP-21 MX
Michael C. Petruzzello and Jerrel R. Mitchell 26 Jun. 1979 71 p
(AD-A074068; DRDMI-T-79-65) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report contains the description of four computer codes developed for the HP-21 MX minicomputer system housed in the Control System Branch of the Guidance and Control Directorate of the US Army Missile Research and Development Command (MIRADCOM). These codes (programs) were developed to aid in analyzing fire control systems being developed by the US Army. GRA

N80-15847# Mound Lab., Miamisburg, Ohio.
UTILITY AND MATH SUBROUTINES FOR THE M6800 MICROPROCESSOR
R. E. Bowman 31 Oct. 1978 89 p refs
(Contract EY-76-C-04-0053)
(MLM-2564) Avail: NTIS HC A05/MF A01

Programming the M6800 microprocessor for data acquisition and instrument control is done in assembly language. A large group of subroutines are presented in a single package to simplify the work of the assembly language programmer. The routines available include utility routines for input/output, code interconversion, delay, etc., and math routines for both integer and floating-point arithmetic. DOE

N80-15848# Argonne National Lab., Ill.
SOFTWARE DEVELOPMENT SYSTEM FOR SMALL DEDICATED AND FRONT-END MICROCOMPUTER (LSI-11) APPLICATIONS
J. W. Tippie and P. E. Rynes 1978 5 p refs
(Contract W-31-109-eng-38)
(CONF-7811112-1) Avail: NTIS HC A02/MF A01

The development of software for small dedicated microcomputer applications is frequently impeded or complicated by lack of adequate peripherals, utilities, and operating systems. A software development system for the LSI-11 microcomputer is described, along with some of its anticipated applications and some of the software problems. The term small dedicated application is used to refer to one or few-of-a-kind systems based on the LSI-11 that lack a device suitable to support an operating system, and that are not subject to frequent software changes. DOE

N80-15849# California Univ., Livermore. Lawrence Livermore Lab.
REBEL/BASIC: LANGUAGE, A USER'S GUIDE
M. C. Zarnstorff and J. R. Greenwood 12 Mar. 1979 104 p
(Contract W-7405-eng-48)
(UCRL-52668) Avail: NTIS HC A06/MF A01

A programmer's reference manual for the REBEL/BASIC computer language is described. In the first section, the generic features of the language are described, including statements, types, execution modes and operators. The second section describes each valid statement in REBEL/BASIC in detail. The statements are discussed in alphabetical order and thus this section is suitable for use as a language reference manual. DOE

N80-15850# National Technical Information Service, Springfield, Va.
PROGRAMMING LANGUAGE DESIGN. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Aug. 1979
Brian Carrigan Sep. 1979 188 p Supersedes NTIS/PS-77/0864; NTIS/PS-76/0747; NTIS/PS-75/588; NTIS/PS-78/0963
(NTIS/PS-79/0979/9; NTIS/PS-78/0963; NTIS/PS-77/0864; NTIS/PS-76/0747; NTIS/PS-75/588) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Research reports on the design, development, and implementation of programming languages are presented. Specifications and applications for the programming languages in systems development, and their use in specific cases are included as well as research on language compilers, syntax, semantics, and logic modules. This updated bibliography contains 181 abstracts, 10 of which are new entries to the previous edition. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N80-15851# Wisconsin Univ. - Madison. Dept. of Mechanical Engineering.
INVESTIGATION OF ADAPTIVE CONTROL FOR RECOIL MECHANISMS Final Report, 1 Mar. 1977 - 31 Mar. 1979
S. M. Wu and A. Ma Aug. 1979 92 p
(Grants DAAG29-77-G-0076; DAAG29-78-G-0075)
(AD-A074024; ARO-14618.1-A-E) Avail: NTIS HC A05/MF A01 CSCL 09/2

The Continuous System Simulation Language (CSSL) computer programs are developed in conjunction with the derivation of the mathematical models and optimum algorithm to study the effect of various orifice control laws on the optimal control for the M-37 recoil mechanism. The optimal control greatly decreases the average rod pull peak force and causes the force to level out to a nearly constant value following the peak. Based on the analysis of the acceleration signals of the recoil mechanism, a microprocessor based digital controller is designed to control the orifice area controller. GRA

N80-15852# Pittsburgh Univ., Pa. Dept. of Computer Science.
SYSTOLIC PRIORITY QUEUES Interim Report
Charles E. Leiserson Apr. 1979 18 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-22255)
(AD-A074494) Avail: NTIS HC A02/MF A01 CSCL 09/2

Advances in microelectronics have made the realization of smart data structures a practical reality. VLSI gives us the capability of building logic-in-memory hardware that will drastically change how things are computed. Models of computation based solely on the Von Neumann architecture will be insufficient to evaluate algorithms. Multiprocessor devices like the systolic multiqueue will introduce new cost functions to the sequential algorithm designer. But much work must be done to define and examine the models of parallel computation that lie between the mathematical world of computable functions and the physical world of space and time. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-15853*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ANALYSIS TECHNIQUES FOR MULTIVARIATE ROOT LOCI
Peter M. Thompson, Gunter Stein, and Alan J. Laub Jan. 1980 37 p refs
(Contract NsG-1551)
(NASA-CR-162570; LIDS-P-965) Avail: NTIS HC A03/MF A01 CSCL 12A

Analysis and techniques are developed for the multivariable root locus and the multivariable optimal root locus. The generalized eigenvalue problem is used to compute angles and sensitivities for both types of loci, and an algorithm is presented that determines the asymptotic properties of the optimal root locus. Author

N80-15854*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDIES IN ASTRONOMICAL TIME SERIES ANALYSIS: MODELING RANDOM PROCESSES IN THE TIME DOMAIN
Jeffrey D. Scargle Dec. 1979 215 p refs
(NASA-TM-81148; A-7959) Avail: NTIS HC A10/MF A01 CSCL 12A

Random process models phased in the time domain are used to analyze astrophysical time series data produced by random processes. A moving average (MA) model represents the data as a sequence of pulses occurring randomly in time, with random amplitudes. An autoregressive (AR) model represents the correlations in the process in terms of a linear function of past values. The best AR model is determined from sampled data and transformed to an MA for interpretation. The randomness of the pulse amplitudes is maximized by a FORTRAN algorithm which is relatively stable numerically. Results of test cases are given to study the effects of adding noise and of different distributions for the pulse amplitudes. A preliminary analysis of the optical light curve of the quasar 3C 273 is given. K.L.

N80-15855# Los Alamos Scientific Lab., N. Mex.
GENERAL LEAST-SQUARES FITTING PROCEDURES TO MINIMIZE THE VOLUME OF A HYPERELLIPSOID
E. A. Wadlinger 1979 5 p refs Presented at Linear Accelerator Conf., Montauk, N.Y., 10-14 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2330; CONF-790927-2) Avail: NTIS HC A02/MF A01

Several methods for determining the shape parameters, which in two dimensions are the Courant-Snyder parameters, and the volume of an ellipse or hyperellipse that represent a set of phase-space points in a two or more dimensional hyperspace are presented. The ellipse parameters are useful for matching a beam to an accelerating or transport system and in studies of emittance growth. The fitting procedure minimizes the total volume of a hyperellipse by adjusting the ellipse shape parameters. The total volume is the sum of the individual particle volumes defined by the hyperellipse that passes through the phase-space point of a particle. A two-dimensional space is considered first; the results are then generalized to higher dimensions. Computer programs using these techniques were written. DOE

N80-15856# Los Alamos Scientific Labj, N. Mex.
SNEX: SEMIANALYTIC SOLUTION OF THE ONE-DIMENSIONAL DISCRETE ORDINATES (S/n) TRANSPORT EQUATIONS WITH DIAMOND DIFFERENCED ANGULAR FLUXES
B. R. Wienke Jun. 1979 28 p refs
(Contract W-7405-eng-36)
(LA-7879-MS) Avail: NTIS HC A03/MF A01

A standard is provided for comparisons of spatial differencing schemes as well as an exact numerical solution to the discrete ordinates equations in one dimensional geometries. Full solutions are generated by numerically integrating the inhomogeneous source terms and adding them to the homogeneous (analytic) solutions in the standard fashion. Simple relationships between angular quadratures permit application of the method to plane, cylindrical and spherical geometries. Analysis is confined to isotropic scattering. Simple theory and methodology are presented and discussed. A code listing and sample problems are also included. DOE

N80-15857# Los Alamos Scientific Lab., N. Mex.
METHODS FOR NUMERICAL CONFORMAL MAPPING
R. Menikoff and C. Zemach Jul. 1979 65 p refs
(Contract W-7405-eng-36)
(LA-7836-MS) Avail: NTIS HC A04/MF A01

Nonlinear integral equations for the boundary functions that determine conformal transformations in two dimensions are developed and analyzed. One of these equations has a nonsingular logarithmic kernel and is especially well suited for numerical computations of conformal maps including those that deal with regions having highly distorted boundaries. Numerical procedures based on interspersed Gaussian quadrature for approximating the integrals and a Newton-Raphson technique to solve the resulting nonlinear algebraic equations are described. The Newton-Raphson iteration converges reliably with very crude initial approximations. Numerical examples are given for the mapping of a half-infinite region with periodic boundary onto a half-plane, with up to 9 figure accuracy for values of the map function on the boundary and for its first derivatives. A differential equation is derived that relates changes in the map function to changes of the boundary. DOE

N80-15858# Brookhaven National Lab., Upton, N. Y.
NUMERICAL METHODS FOR HELMHOLTZ TYPE EQUATIONS IN UNBOUNDED REGIONS
C. I. Goldstein May 1979 21 p refs
(Contract EY-76-C-02-0016)
(BNL-26543) Avail: NTIS HC A02/MF A01

Numerical methods for approximately solving Helmholtz type equations on unbounded regions in two and three dimensional space subject to appropriate radiation conditions at infinity, are described. DOE

N80-15859# California Univ., Berkeley. Lawrence Berkeley Lab.
FINITE ELEMENT METHOD FOR THE SOLUTION OF A POTENTIAL THEORY INTEGRAL EQUATION
M. J. Friedman Aug. 1979 11 p refs
(Contract W-7405-eng-48)
(LBL-9504) Avail: NTIS HC A02/MF A01

A finite element approximation for an integral equation of the second kind deduced from a potential theory boundary value problem in two variables is discussed. The equation is shown to admit a unique solution, to be variational and coercive in the Hilbert space of functions sigma an element of H/sup 1/2/ (gamma), integral/sub gamma/sigma d gamma = 0. The Galerkin method with finite elements as trial functions is shown to lead to an optimal rate of convergence. DOE

N80-15860# Argonne National Lab., Ill.
ERGODIC THEOREMS FOR NONLINEAR CONTRACTION SEMIGROUPS IN A HILBERT SPACE
H. G. Kaper and G. K. Leaf Jun. 1979 20 p refs
(Contract W-31-109-eng-38)
(ANL-79-50) Avail: NTIS HC A02/MF A01

Two ergodic theorems are presented for means of nonlinear contraction semigroups in a Hilbert space. These means are generated by a class of averaging kernels which includes the usual Abel and Cesaro-(C, alpha) kernels. DOE

N80-15861# Sandia Labs., Livermore, Calif. Applied Mathematics Div.
NUMERICAL RANK DETERMINATION IN LINEAR LEAST SQUARES PROBLEMS
T. A. Manteuffel Aug. 1979 52 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8243) Avail: NTIS HC A04/MF A01

An interval analysis approach is proposed. A set of matrices A/sup I/ that contains all possible perturbations of A due to uncertainties is defined, and A/sup I/ is called rank deficient if any member of A/sup I/ is rank deficient. A modification to

the Q-R decomposition method of solution of the least-squares problem allows a determination of the rank of A/sup l/. The additional computational effort is O(N squared), where N is the column dimension of A. DOE

N80-15862# Oak Ridge National Lab., Tenn.
REGULARITY OF SOLUTIONS TO AN INHOMOGENEOUS DIFFERENTIAL EQUATION IN BANACH SPACE
C. C. Travis 1979 14 p refs Presented at the Functional Differential and Integral Equations Conf., Morgantown, W. Va., 18 Jun. 1979
(Contract W-7405-eng-26)
(CONF-7906102-1) Avail: NTIS HC A02/MF A01

The class of strongly continuous semigroups was characterized for a weak solution of the equation v(t) = T(t)x + integral equation/sup t/T(t-s)f(s)ds (Eq. B) which is a strong solution when f is an element of C([o, r] X). It is shown that equation du(t)/dt = Au(t) + f(t), u(o) = x is a strong solution of eq. B for every continuous function f if the semigroup T(t), t > or = 0, is of bounded semivariation. DOE

N80-15863# Argonne National Lab., Ill. Applied Mathematics Div.
EQUIVALENCE BETWEEN RESOLVENT CONSISTENCY AND CONVERGENCE FOR NONLINEAR QUASI-CONTRACTIVE ALGORITHMS
S. Reich Jun. 1979 17 p refs
(Contract W-31-109-eng-38)
(ANL-79-53) Avail: NTIS HC A02/MF A01

A reflexive Banach space E with a uniformly Gateaux differentiable norm; D, a closed convex subset of E; and C, a nonexpansive retract of D is considered. DOE

N80-15864# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
COMPARISON OF BOUNDARY ELEMENT AND FINITE ELEMENT METHODS IN TWO-DIMENSIONAL INELASTIC ANALYSIS
M. Morjaria, V. Sanhan, and S. Mukherjee May 1979 34 p refs
(Contract EY-76-S-02-2733)
(COO-2733-22) Avail: NTIS HC A03/MF A01

Planar time-dependent inelasticity problems were considered using the finite element method and the boundary element method. A constitutive model with state variables was used to describe material behavior. The accuracy and computational efficiency of these two methods were compared. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

No abstracts in this category.

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-15865*# SRI International Corp., Menlo Park, Calif.
DOCUMENTATION OF THE ANALYSIS OF THE BENEFITS AND COSTS OF AERONAUTICAL RESEARCH AND TECHNOLOGY MODELS, VOLUME 1 Final Report
J. C. Bobick, R. L. Braun, and R. E. Denny Jul. 1979 203 p
(Contract NAS2-10026; SRI Proj. 7759)
(NASA-CR-152278) Avail: NTIS HC A10/MF A01 CSCL 12B

The analysis of the benefits and costs of aeronautical research and technology (ABC-ART) models are documented. These models were developed by NASA for use in analyzing the economic feasibility of applying advanced aeronautical technology to future civil aircraft. The methodology is composed of three major modules: fleet accounting module, airframe manufacturing module, and air carrier module. The fleet accounting module is used to estimate the number of new aircraft required as a function of time to meet demand. This estimation is based primarily upon the expected retirement age of existing aircraft and the expected change in revenue passenger miles demanded. Fuel consumption estimates are also generated by this module. The airframe manufacturer module is used to analyze the feasibility of the manufacturing the new aircraft demanded. The module includes logic for production scheduling and estimating manufacturing costs. For a series of aircraft selling prices, a cash flow analysis is performed and a rate of return on investment is calculated. The air carrier module provides a tool for analyzing the financial feasibility of an airline purchasing and operating the new aircraft. This module includes a methodology for computing the air carrier direct and indirect operating costs, performing a cash flow analysis, and estimating the internal rate of return on investment for a set of aircraft purchase prices. R.C.T.

N80-15866*# SRI International Corp., Menlo Park, Calif.
DOCUMENTATION OF THE ANALYSES OF THE BENEFITS AND COSTS OF AERONAUTICAL RESEARCH AND TECHNOLOGY MODELS (ABC-ART). VOLUME 2: APPENDICES Final Report
J. C. Bobick, R. L. Braun, and R. E. Denny 1980 160 p
(Contract NAS2-10026; SRI Proj. 7759)
(NASA-CR-152279) Avail: NTIS HC A08/MF A01 CSCL 12B

Fleet variables are defined, and source codes for each module are presented. R.C.T.

N80-15867# Pittsburgh Univ., Pa. Inst. for Statistics and Applications.
ESTIMATION OF VARIANCE COMPONENTS Interim Report
C. Radhakrishna Rao and Jurgen Kleffe Jul. 1979 63 p refs
(Contract F49620-79-C-0161; AF Proj. 2304)
(AD-A074223; TR-79-1; AFOSR-79-0974TR) Avail: NTIS HC A04/MF A01 CSCL 12/2

The paper describes a number of methods for estimating variance components in a general linear model. Explicit expressions are obtained for locally minimum variance unbiased estimators with and without the invariance condition. The principle of MINQE is described and a series of MINQE estimators satisfying one or more of the conditions - unbiasedness, invariance, nonnegative definiteness - are derived. Corresponding to each MINQE estimator, an iterated MINQE (IMINQE) is defined. It is shown that the ML (maximum likelihood) estimator is IMINQE satisfying the invariance condition and the RML (restricted maximum likelihood estimator) is IMINQE satisfying both the invariance and unbiasedness conditions. Some comments are made on the numerical algorithms for computing MINQE, ML and RML estimators. GRA

N80-15868# General Research Corp., McLean, Va. Operations Analysis Group.
ANALYSIS TO DETERMINE FUNCTIONAL AND SYSTEMS REQUIREMENTS FOR AN ON-LINE STRUCTURE AND COMPOSITION SYSTEM (SACS). REPORT OF TASK E: ANALYSIS OF CURRENT AND DEVELOPING SYSTEMS WHICH INTERFACE WITH LOGSACS AND PERSACS TO DETERMINE TO WHAT EXTENT THEY DO OR DO NOT SUPPORT THE DATA REQUIREMENTS OF AN ON-LINE SACS Final Report
Francis O. Deppner, John J. Anderson, and Whitney C. Scully Jun. 1979 28 p refs
(Contract MDA903-78-C-0445)
(AD-A074638; GRC-1070-04-79-CR) Avail: NTIS HC A03/MF A01 CSCL 05/1

There are current and developing systems which either provide, or will be required to provide, data to SACS. These systems were analyzed to determine if they do/do not support an improved/on-line SACS. The support provided is very limited; therefore, the shortcomings of each of the systems were identified and recommendations for their improvement were provided. Recommendations were also provided for a new system to support phasing plus some new managerial procedures. Report of

Task E - analyze the current and developing systems which interface with LOGSACS and PERSACS to determine to what extent they support or do not support the data requirements of an on-line SACS. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-15869*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

CHARACTERIZATION OF ACOUSTIC DISTURBANCES IN LINEARLY SHEARED FLOWS

S. P. Koutsoyannis Jul. 1978 40 p refs

(Grants NsG-2215; NsG-2233; NsG-2007)

(NASA-CR-162577; SU-JIAA-TR-12) Avail: NTIS HC A03/MF A01 CSCL 20A

The equation describing the plane wave propagation, the stability, or the rectangular duct mode characteristics in a compressible inviscid linearly sheared parallel, but otherwise homogeneous flow, is shown to be reducible to Whittaker's equation. The resulting solutions, which are real, viewed as functions of two variables, depend on a parameter and an argument, the values of which have precise physical meanings depending on the problem. The exact solutions in terms of Whittaker functions are used to obtain a number of known results of plane wave propagation and stability in linearly sheared flows as limiting cases in which the speed of sound goes to infinity (incompressible limit) or the shear layer thickness, or wave number, goes to zero (vortex sheet limit). The usefulness of the exact solutions is then discussed in connection with the problems of plane wave propagation and the stability of a finite thickness layer with a linear velocity profile. Author

N80-15870*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

FEATURES OF SOUND PROPAGATION THROUGH AND STABILITY OF A FINITE SHEAR LAYER

S. P. Koutsoyannis Aug. 1977 19 p refs Presented at 13th Ann. Meeting of the Soc. of Eng. Sci., Hampton, Va. Sponsored by NASA

(NASA-CR-162465; JIAA-TR-5) Avail: NTIS HC A02/MF A01 CSCL 20A

The plane wave propagation, the stability, and the rectangular duct mode problems of a compressible, inviscid, linearly sheared, parallel, homogeneous flow are shown to be governed by Whittaker's equation. The exact solutions for the perturbation quantities are essentially the Whittaker M-functions where the nondimensional quantities have precise physical meanings. A number of known results are obtained as limiting cases of the exact solutions. For the compressible finite thickness shear layer it is shown that no resonances and no critical angles exist for all Mach numbers, frequencies, and shear layer velocity profile slopes except in the singular case of the vortex sheet. K.L.

N80-15871*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

AN EXPERIMENTAL STUDY OF THE STRUCTURE AND ACOUSTIC FIELD OF A JET IN A CROSS STREAM

Ivan Camelier and K. Karamcheti Jan. 1976 134 p refs

(Grants NGL-05-020-526; NsG-2007)

(NASA-CR-162464; SU-JIAA-TR-2) Avail: NTIS HC A07/MF A01 CSCL 20A

The plane of symmetry of a high speed circular jet was surveyed to measure the mean and turbulent velocity fields by using constant temperature hot wire anemometry. The intensity of the noise radiated from the jet was determined in the tunnel test section by utilizing the cross-correlation at a particular time delay between the signals of two microphones suitably located along a given direction. Experimental results indicate that the turbulent intensity inside the crossflow jet increases by a factor of (1 + 1/2) as compared to the turbulent intensity of the same jet under free conditions, with r indicating the ratio of the jet velocity by the cross stream velocity. The peak observed in the turbulence spectra obtained inside the potential core of the jet has a frequency that increases by the same factor with respect to the corresponding frequency measured in the case of the free jet. The noise radiated by the jet becomes more intense as the crossflow velocity increases. The measured acoustic intensity of the crossflow jet is higher than the value which would be expected from the increase of the turbulent intensity only. A.R.H.

N80-15872*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.

ON THE OUTPUT OF ACOUSTICAL SOURCES

H. Levine May 1979 35 p refs

(Grant NsG-2215)

(NASA-CR-162576; SU-JIAA-TR-16) Avail: NTIS HC A03/MF A01 CSCL 20A

Contents: (1) a theoretical basis for local power calculation; (2) source radiation in the presence of a half-plane; (3) radiation from a line source near an edge at which a Kutta condition holds; (4) radiation by a point source above a plane independence boundary; and (5) power output of a point source in a uniform flow. A.R.H.

N80-15873*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

ACOUSTIC RESONANCES AND SOUND SCATTERING BY A SHEAR LAYER

S. P. Koutsoyannis, K. Karamcheti, and D. C. Galant (NASA, Ames Research Center, Moffett Field, Calif.) Sep. 1979 46 p refs

(Grants NsG-2233; NsG-2308)

(NASA-CR-162575; SU-JIAA-TR-20) Avail: NTIS HC A03/MF A01 CSCL 20A

The energy reflection coefficient is evaluated numerically for plane waves incident on a plane shear layer having a linear velocity profile. The shear layer is found to exhibit no resonances and no Brewster angles. The behavior of the reflection coefficient depends crucially on the parameter tau, a nondimensional measure of the disturbance Strouhal number with respect to the disturbance Mach number in the mean flow direction. For moderate values of tau, the amplified reflection regime degenerates into the total reflection one, whereas in the ordinary reflection regime the variation of the reflection coefficient with tau depends on whether or not the corresponding vortex sheet has a Brewster angle. The results indicate that caution should be exercised in uncritically modeling a finite thickness shear layer by a corresponding vortex sheet. K.L.

N80-15874*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A STUDY OF PARTIAL COHERENCE FOR IDENTIFYING INTERIOR NOISE SOURCES AND PATHS ON GENERAL AVIATION AIRCRAFT

James T. Howlett Dec. 1979 17 p refs Presented at 98th Acoust. Soc. of Am. Meeting, Salt Lake City, 26-30 Nov. 1979 (NASA-TM-80197) Avail: NTIS HC A02/MF A01 CSCL 20A

The partial coherence analysis method for noise source/path determination is summarized and the application to a two input, single output system with coherence between the inputs is illustrated. The augmentation of the calculations on a digital computer interfaced with a two channel, real time analyzer is also discussed. The results indicate possible sources of error in the computations and suggest procedures for avoiding these errors. M.G.

N80-15875*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SUMMARY AND EVALUATION OF SEMI-EMPIRICAL METHODS FOR THE PREDICTION OF HELICOPTER ROTOR NOISE
Robert J. Pegg Dec. 1979 96 p refs
(NASA-TM-80200) Avail: NTIS HC A05/MF A01 CSCL 20A

Existing prediction techniques are compiled and described. The descriptions include input and output parameter lists, required equations and graphs, and the range of validity for each part of the prediction procedures. Examples are provided illustrating the analysis procedure and the degree of agreement with experimental results. M.G.

N80-15876*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF INLET SUPPRESSOR DATA WITH APPROXIMATE THEORY BASED ON CUTOFF RATIO
Edward J. Rice and Laurence J. Heidelberg [1979] 28 p refs Presented at the AIAA Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980
(NASA-TM-81386; E-294) Avail: NTIS HC A03/MF A01 CSCL 20A

Inlet suppressor far-field directivity suppression was quantitatively compared with that predicted using an approximate linear design and evaluation method based upon mode cutoff ratio. The experimental data was obtained using a series of cylindrical point-reacting inlet liners on a YF102 engine. The theoretical prediction program is based upon simplified sound propagation concepts derived from exact calculations. These indicate that all of the controlling phenomenon can be approximately correlated with mode cutoff ratio which itself is intimately related to the angles of propagation within the duct. The theory-data comparisons are intended to point out possible deficiencies in the approximate theory which may be corrected. After all theoretical refinements are made, then empirical corrections can be applied. A.R.H.

N80-15877# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
MICROCOMPUTER-CONTROLLED ULTRASONIC DATA ACQUISITION SYSTEM
W. A. Simpson, Jr. Nov. 1978 53 p
(Contract W-7405-eng-26)
(ORNL/TM-6531) Avail: NTIS HC A04/MF A01

A mobile, high-speed data acquisition and storage system was developed. The system is controlled by an Intel 8080A microprocessor. The MCS80-SDK microcomputer board was chosen, and magnetic tape is used as the storage medium. A detailed description is provided of both the hardware and software developed to interface the magnetic tape storage subsystem to Biomation 8100 and Biomation 805 waveform recorders. A boxcar integrator acquisition system is also described for use when signal averaging becomes necessary. Both assembly language and machine language listing are provided for the software. DOE

N80-15878# Sandia Labs., Albuquerque, N. Mex. Environmental Research Div.
ATTEMPT TO MEASURE SONIC BOOM CAUSTICS SUPERSONIC HVAR ROCKET SLEDS
J. W. Reed Jun. 1979 42 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1541) Avail: NTIS HC A03/MF A01

Fifteen rocket sled tests were performed in an attempt to measure extreme overpressure magnifications in the sonic boom caustic created by accelerating supersonic vehicles. These sleds with 25-HVAR-rocket motors were accelerated to about 425 m/s, Mach 1.25, on a 1500 m track. It was established that sonic boom bow waves from these events were not strongly focused by propagation to 600 to 900 m from the track. It appears that nonlinear acoustic aperture effects prevented sharp focusing. Only 15 to 30% overpressure magnifications were recorded by an array of pressure gages. DOE

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-15879# Oak Ridge National Lab., Tenn.
ELECTRON IMPACT IONIZATION OF MULTICHARGED IONS
D. H. Crandall, D. C. Gregory, and R. A. Phaneuf Sep. 1979 36 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7020) Avail: NTIS HC A03/MF A01

Experimental data are presented in tabular and graphical form for electron impact ionization cross sections of the ions B(3+), C(3+), C(4+), N(3+), N(4+), N(5+), O(3+), O(4+), O(5+), and Ar(4+) energies between the ionization thresholds and 1500 eV, with absolute accuracy varying between +-6% and +-17%. At present there are no other measurements of comparable accuracy for ions of initial charge greater than 2+. Calculated cross sections from the Lotz formula and scaled-Coulomb-Born prescription are compared with the data. Ionization rate coefficients for plasmas with Maxwellian electron energy distribution were computed from the measured cross sections for each ion species. These rates are compared with available theoretical and measured plasma ionization rates. DOE

N80-15880# Texas A&M Univ., College Station.
FAST NUMERICAL CALCULATIONS OF ION-ATOM COLLISIONS
J. F. Reading, A. L. Ford, and R. L. Becker 1979 25 p refs Presented at the Workshop on Inner Shell Processes, Linz, Austria, 14 May 1979 Prepared in cooperation with ORNL
(Contract W-7405-eng-26)
(CONF-7905111-1) Avail: NTIS HC A02/MF A01

When a ion impinges on an atom, the cross sections for electronic transitions can be described in the independent electron model by functions of single electron amplitudes. A single centered expansion of the time-dependent wave function of an electron about the heavier nucleus, with charge Z/sub N/, is shown to be moderately successful in explaining the dependence of K-shell hole production on the charge, Z/sub p/, of the projectile. However, capture of electrons by the projectile is important for a complete understanding and can be incorporated, in principle, in the single-center approach by evaluation of a transition matrix element involving a final state on the projectile. A method was devised which allows convergence in the truncated expansion of Hilbert states. Comparisons are made to experiment. Future developments are discussed. DOE

N80-15881# California Univ., Livermore. Lawrence Livermore Lab.
SCALED HYDROGENIC APPROXIMATION WAVE FUNCTIONS
B. W. Shore Sep. 1979 12 p refs
(Contract W-7405-eng-48)
(UCID-18167) Avail: NTIS HC A02/MF A01

Analytic expressions for atomic wave functions are presented and discussed. An approach which employs hydrogenic functions, suitably scaled, as approximate wave functions is described. The typical inaccuracies to be expected from such approximations are discussed. DOE

N80-15882# Massachusetts Inst. of Tech., Cambridge.
DEFORMED SHAPES OF HADRONS
J. Parmentola Jun. 1979 21 p refs
(Contract EY-76-C-02-3069)
(COO-3069-T1) Avail: NTIS HC A02/MF A01

The possibility that the shape of the ground state configuration of a system of quarks interacting with a real scalar field is nonspherical is examined. The application of the variational principle to a simple model field theory of quarks coupled linearly to a real scalar field is used for the investgation. The model is applied to hadron spectroscopy for low lying nonstrange baryons. DOE

N80-15883# Stanford Linear Accelerator Center, Calif.
QUARK STRUCTURE FUNCTIONS OF MESONS, FRAGMENTATION FUNCTIONS, HIGHER-TWIST EFFECTS IN QCD, DEEP INELASTIC SCATTERING, AND THE DRELL-YAN PROCESS
E. L. Berger Jul. 1979 23 p refs Presented at the Intern. Conf. on High Energy Phys., Geneva, 27 Jun. 1979
(Contract EY-76-C-03-0515)
(SLAC-PUB-2362; CONF-790642-5) Avail: NTIS HC A02/MF A01

The specific effects associated with constituent binding in hadronic wave functions are examined. The wave functions are shown to be nonscaling, nonfactorizing 1/Q to the second power contributions to cross sections for semi-inclusive deep inelastic scattering, the Drell-Yan process, and other hard scattering reactions. Predictions for the 1/Q to the second power higher-twist terms and for the azimuthal angle dependence of the cross sections are discussed. DOE

N80-15884# Pennsylvania State Univ., University Park.
MULTICONFIGURATION HARTREE-FOCK METHOD FOR ATOMIC ENERGY LEVELS AND TRANSITION PROBABILITIES
C. F. Fischer 1978 17 p refs Presented at the 6th Intern. Conf. on Atomic Phys., Riga, 17-22 Aug. 1978
(Contract EG-77-S-02-4264)
(COO-4264-3; CONF-7808110-1) Avail: NTIS HC A02/MF A01

The effect of correlation in the motion of electrons in a many electron system is considered in the theoretical determination of atomic properties. The correlation effects are computed using the configuration interaction. Restriction is made to the discussion of outer processes of neutral atoms or ions of low degree of ionization in which the relativistic effects are small. The multiconfiguration Hartree-Fock method is used for cases which are treated as two electron systems. The first order theory and f values in the presence of crossovers are discussed. DOE

N80-15885# Texas A&M Univ., College Station. Dept. of Physics.
NUCLEON-NUCLEON SCATTERING PHASE SHIFTS
R. Bryan 1978 19 p refs Presented at the Conf. on Few Body Sys. and Nucl. Forces, Graz, Austria, 24 Aug. 1978
(Contract EY-76-S-05-5223)
(ORO-5223-12; CONF-780833-7) Avail: NTIS HC A02/MF A01

A number of nucleon-nucleon elastic and inelastic phase parameters from 0 to 800 MeV are presented and described. Phase shifts for the 1 = 1 states and the 1 = 0 states are examined. A.W.H.

N80-15886# Pittsburgh Univ., Pa. Dept. of Physics and Astronomy.
SOME FEATURES OF RAYLEIGH SCATTERING FROM LIGHT ATOMS AND IONS
J. C. Parker and R. H. Pratt 18 Jul. 1979 21 p refs
(Contract W-7405-eng-48)
(UCRL-15046) Avail: NTIS HC A02/MF A01

The Rayleigh scattering cross sections for atoms and ions of low nuclear charge, particularly for photon energies in the vicinity of the threshold for photoionization from the K-shell are discussed. A sequence of resonances in the elastic scattering amplitude which occur at an energy corresponding to the excitation of a K-shell electron to a higher unfilled shell is examined. An isonuclear sequence is discussed in which the K-shell amplitudes share a common curve differing only in the position of the threshold. DOE

N80-15887# Oak Ridge National Lab., Tenn.
DIAGNOSTIC NEUTRAL BEAMS FOR SPECTROSCOPIC STUDIES OF IMPURITIES BY CHARGE-TRANSFER REACTIONS
R. C. Isler and J. F. Lyon 1979 6 p refs Presented at DOE Workshop on Plasma Wall Interactions, Germantown, Md., 31 May 1979
(Contract W-7405-eng-26)
(CONF-790585-2) Avail: NTIS HC A02/MF A01

Charge transfer reactions between hydrogen atoms and impurities are examined as a means for measuring the concentrations of fully stripped ions which exist throughout the volume of a confined plasma. An example is presented of a measurement of O(8+) from the ISX-B Tokamak where a heating neutral beam provides a source of neutral hydrogen in the plasma center. The possibility of more systematic analysis with better spatial resolution using a diagnostic beam is discussed. DOE

N80-15888# California Univ., Berkeley. Lawrence Berkeley Lab.
HEAVY ION COLLISIONS AT RELATIVISTIC ENERGIES
S. Nagamiya Jul. 1979 70 p refs Presented at Symp. on Heavy Ion Phys. from 10-200 MeV/A, Upton, N.Y., 16 Jul. 1979
(Contract W-7405-eng-48)
(LBL-9494; CONF-790743-3) Avail: NTIS HC A04/MF A01

The current understanding of the reaction mechanism is reviewed and described with the major interests related to geometry and dynamics. Also recent measurements of some new phenomena which cannot be easily explained within the framework of the available theoretical tools, phenomena that were observed at beam energies of 0.4 to 2 GeV/A are described. Topics for future study are briefly mentioned especially in connection with the study of collisions at beam energies of 10 to 200 Mev/A. DOE

N80-15889# Ames Lab., Iowa.
BILOCAL FIELD THEORY AND A MODEL FOR MESON SPECTROSCOPY, PART 1. TRIDENT PRODUCTION BY HIGH ENERGY CHARGED PARTICLES ON NUCLEI, PART 2 Ph.D. Thesis - Iowa State Univ.
K. Mita May 1979 135 p refs
(Contract W-7405-eng-82)
(IS-T-861) Avail: NTIS HC A07/MF A01

Bilocal field theory for quark confinement is considered in a combination of bilocal field theory with the covariant harmonic oscillator quark model. The formalism is viewed as a direct generalization of local Lagrangian field theory. The variational principle which is used to find the Euler-Lagrange equation for the bilocal field is discussed. A class of Lagrangian densities satisfying a boundary condition on the hypersurface of the internal domain, which is called the cell, are determined and the Lagrangian density with an internal covariant harmonic oscillator interaction is introduced to describe the static properties of the mesons. Calculations of trident production by high energy charged particles on nuclei in the framework of covariant perturbation theory are presented. The lowest order calculations are described in detail for pair production by charged bosons. Cross section formulas for the fermion primary, which is taken to be the proton for concreteness, are presented. DOE

N80-15890# American Univ., Washington, D. C.
LARGE MOMENTUM TRANSFER ELECTRON SCATTERING FROM FEW-NUCLEON SYSTEMS
R. G. Arnold Aug. 1979 18 p refs Presented at Intern. School of Intermediate Energy Nucl. Phys., Ariccia, Italy, 18 Jun. 1979
(Contract EY-76-C-03-0515)
(SLAC-PUB-2373) Avail: NTIS HC A02/MF A01

The experimental results from a series of measurements of large momentum transfer electron scattering at forward angles from nuclei with A less than or equal to 4 are reviewed. Theoretical interpretations of these data in terms of traditional nuclear physics models and in terms of quark constituent models are described. Some physics questions for future experiments are explored, and a preview of possible future measurements of magnetic structure functions of light nuclei at large Q to the 2nd power is given. DOE

N80-15891# Stanford Linear Accelerator Center, Calif.
PRODUCTION OF NEUTRINOS AND NEUTRINO-LIKE PARTICLES IN PROTON-NUCLEUS INTERACTIONS Ph.D. Thesis
J. P. Dishaw Mar. 1979 82 p refs
(Contract EY-76-C-03-0515)
(SLAC-216) Avail: NTIS HC A05/MF A01

The direct production of neutrinos or neutrino like particles, i.e., neutral particles which interact weakly with hadrons, in proton-nucleus interactions at 400 GeV incident proton energy was examined. Possible sources of such particles include the semi-leptonic decay of new heavy particles such as charm, and the direct production of a light neutral Higgs particle such as the axion. The production of these particles was inferred by energy nonconservation in the collision of a proton with an iron nucleus. The total visible energy of the interaction was measured using a sampling ionization calorimeter. Energy nonconservation in the data is manifest as a non Gaussian distribution on the low side of the calorimeter measured energy. Model calculations which yielded the fraction of events expected in this non Gaussian behavior for the various sources of neutrinos or neutrino like particles are discussed. DOE

N80-15892# Los Alamos Scientific Lab., N. Mex.
QUANTITATIVE COMPARISON OF MULTIPLE-PHOTON ABSORPTION IN POLYATOMIC MOLECULES
O. P. Judd 1979 56 p refs Presented at 4th Intern. Conf. on Laser Spectry., Rottach-Egern, West Germany, 11 Jun. 1979
(Contract W-7405-eng-36)
(CONF-790690-3) Avail: NTIS HC A04/MF A01

A quantitative comparison of multiple photon absorption for a number of polyatomic molecules is presented. A basis for this comparison was developed which takes into account the different experimental conditions and molecular parameters, and provides suitable normalization of the fluence and absorption parameters. The normalization, and consequently the generalized interaction process is specified in terms of the spectroscopic absorption cross section of the molecule and the effective fraction of molecules that interact with the radiation field. The results of the study indicate that in terms of the normalized absorption variables, multiple-photon absorption is a general phenomena that is qualitatively the same for all molecules. Quantitative values of the radiation field and the functional dependence of eta(PHI) on the experimental parameters such as gas pressure, optical bandwidth, and optical pulse duration are derived. These results are compared with the anharmonic oscillator model for multiple photon excitation of polyatomic molecules. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-15893# Department of Energy, Washington, D. C. Office of Nuclear Energy Programs.
FISSION ENERGY PROGRAM OF THE U.S. DEPARTMENT OF ENERGY, FY 1980
Apr. 1979 315 p refs
(DOE/ET-0089) Avail: NTIS HC A14/MF A01

The fission energy program and program objectives are discussed. The program management and program strategy are described and the program budget is presented. The topics in the program which are discussed include thermal reactor technology, advanced isotope separation technology, water cooled breeders, gas cooled breeders, and space power applications. A.W.H.

N80-15894# California Univ., Livermore. Lawrence Livermore Lab.
SEISMIC SAFETY IN NUCLEAR-WASTE DISPOSAL
D. W. Carpenter and Donald Towse 26 Apr. 1979 62 p refs
(Contract W-7405-eng-48)
(UCID-18125) Avail: NTIS HC A04/MF A01

Data on damage to underground equipment and structures from earthquakes, the record of associated motions, and the conventional methods of seismic safety-analysis and engineering are considered. Safety considerations may be divided into two classes: those during the operational life of a disposal facility, and those pertinent to the post-decommissioning life of the facility. Operational hazards may be mitigated by conventional construction practices and site selection criteria. Events that would materially affect the long-term integrity of a decommissioned facility appear to be highly unlikely and can be substantially avoided by conservative site selection and facility design. These events include substantial fault movement within the disposal facility and severe ground shaking in an earthquake epicentral region. Techniques need to be developed to address the question of long-term earthquake probability in relatively aseismic regions, and for discriminating between active and extinct faults in regions where earthquake activity does not result in surface ruptures. DOE

N80-15895# Dames and Moore, White Plains, N. Y.
APPLICABILITY OF A GENERIC MONITORING PROGRAM FOR RADIOACTIVE WASTE BURIAL GROUNDS AT OAK RIDGE NATIONAL LABORATORY AND IDAHO NATIONAL ENGINEERING LABORATORY
Jul. 1978 92 p refs
(Contract W-7405-eng-26)
(ORNL/SUB-7167-1) Avail: NTIS HC A05/MF A01

Because data available on the burial grounds were insufficient for an adequate understanding of radionuclide migration patterns and accordingly, inadequate for the design of reliable monitoring programs, preliminary monitoring programs were designed in order to obtain additional data for a later implementation of reliable monitoring programs. The monitoring programs designed for ORNL consist primarily of the installation of surface water monitoring stations, the surveillance of trench sump wells, a test boring program to study subsurface geologic conditions, a ground water sampling program and the installation of instrumentation, specifically infiltrometers and evaporation pans, to develop data on the water balances. The program designed for the INEL burial ground includes installation of trench sumps, a ground water monitoring program, test borings to further define subsurface geohydrologic conditions and the installation of instrumentation to develop data on the site water balance. The estimated costs of implementing the recommended programs are included. DOE

N80-15896# California Univ., Livermore. Lawrence Livermore Lab.
GEOLOGIC FACTORS IN NUCLEAR WASTE DISPOSAL M.S. Thesis
Donald Towse Jul. 1978 29 p refs
(Contract W-7405-eng-48)
(UCRL-52522) Avail: NTIS HC A03/MF A01

The geosciences and their relation to nuclear waste disposal and management are discussed. The problems of nuclear waste disposal and the hydrology, chemistry, and geometry of the nuclear waste migration process are examined. A computer simulation program developed to model and calculate nuclear waste migration from the repository to the biosphere is presented. The factors of the waste migration process are delineated including risk calculations of different media, geometries, potential individual and population dose, and radiation effects. A.W.H.

N80-15897# Brookhaven National Lab., Upton, N. Y.
FUSION ENERGY FOR HYDROGEN PRODUCTION
J. A. Fillo, J. R. Powell, M. Steinberg, R. Benenati (N.Y. Polytechnic Inst.), V. Dang (Burns and Roe), S. Fogelson (Burns and Roe), H. Isaacs (Burns and Roe), H. Kouts (Burns and Roe), M. Kuschner (Burns and Roe), and O. Lazareth 1978 7 p refs Presented at the 10th Symp. on Fusion Technol., Padova, Italy, 4-8 Sep. 1978
(Contract EY-76-C-02-0016)
(BNL-24906; CONF-780953-6) Avail: NTIS HC A02/MF A01

The use of thermonuclear fusion for the production of hydrogen from water is described. A conceptual design coupling fusion with high temperature electrolysis for the production of hydrogen is examined. Elements in the systems' design discussed are the

fusion blanket, the high temperature electrolyzers, the coupling of the fusion and electrolyzer systems, and the power conversion system. A.W.H.

N80-15898# California Univ., Berkeley. Lawrence Berkeley Lab.
PROSPECTS FOR HIGH ENERGY HEAVY ION ACCELERATORS
Christoph Leemann Mar. 1979 8 p refs Presented at the IEEE Particle Accelerator Conf., San Francisco, 12 Mar. 1979
(Contract W-7405-eng-48)
(LBL-8899; CONF-790327-110) Avail: NTIS HC A02/MF A01

The use of synchrotrons for the acceleration of heavy ions to relativistic energies is examined. The beam performance obtained or projected for the near future at operating facilities is evaluated. The requirements for the design of an ion accelerator such as ion masses beam intensity and desired energy are discussed. The utilization of superconducting magnets and the factor of injector brightness are discussed in relation to the adaption of a synchrotron to an ion acceleration. A.W.H.

N80-15899# California Univ., Livermore. Lawrence Livermore Lab.
TECHNICAL CONCEPT FOR A TEST OF GEOLOGIC STORAGE OF SPENT REACTOR FUEL IN THE CLIMAX GRANITE, NEVADA TEST SITE
L. D. Ramspott, L. B. Ballou, R. C. Carlson, D. N. Montan, T. R. Butkovich, J. E. Duncan, W. C. Patrick, D. C. Wilder, W. G. Brough, and M. C. Mayr 15 Jun. 1979 51 p refs
(Contract W-7405-eng-48)
(UCRL-52796) Avail: NTIS HC A04/MF A01

Spent fuel assemblies from an operating commercial nuclear reactor are to be placed in the Climax granite at the Nevada Test Site with six electrical simulator canisters in a storage drift and their effects compared. The test objectives, the technical issues, the site, and the preoperational measurement program are described along with thermal and mechanical response calculations, the characteristics of the spent fuel, the field instrumentation and data acquisition systems, and the system for handling the spent fuel. DOE

N80-15900# McElroy (Ralph) Co., Austin, Tex.
PARTICLE DYNAMICS IN ION LINEAR ACCELERATOR OPERATING IN DOUBLE FREQUENCY REGIME
V. A. Bomko, V. I. Volkov, Yu. Meleshkova, and N. A. Khiznyak 1979 34 p refs Transl. into ENGLISH of "Dinamika Chastits v Lineinom Uskoritele Ionov v Rezhime Uskoreniya Na Dvukh Volnakh s Kratnoi Chastotoi" Rept No. KhFTI-77-40 AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst., 1977 34 p
(LA-TR-79-19; KHFTI-77-40) Avail: NTIS HC A03/MF A01

The particle dynamics of particle acceleration in an accelerating device of a cavity resonator with type drift tubes under the effect of an electric field is studied. The electric field is the result of the superposition of two simultaneously excited waves with the frequency of the secondary wave being an integral multiple of the primary wave frequency. The phase characteristics of the particle dynamics were determined, the formation process of the bunches and their dynamics along the accelerator were investigated, and the monoenergetic character of the beam at various stages of acceleration was examined. A.W.H.

N80-15901# Kanner (Leo) Associates, Redwood City, Calif.
CALCULATION OF QUADRIPOLAR FOCUSING OF A LINEAR ACCELERATOR AND OF BEAM ADAPTATION IN THE PRESENCE OF A SPACE CHARGE
B. Bru 1979 41 p Transl. into ENGLISH of "Calcul de la Focalisation Quaderipolaire d'un Linac et de l'Adaption du Faisceau en Presence de Charge d'Espace" Report. No. MPS/LIN/70-10 European Organ. for Nucl. Res., Geneva, 5 Nov. 1970 41 p
(LA-TR-79-18; MPS/LIN/70-10) Avail: NTIS HC A03/MF A01

The focusing structure of a proton accelerator (as well as the parameters adapted to this structure) in the presence of space charge forces is determined. The method is described in which the beam is likened to a uniformly charged ellipsoid, and the space charge forces are calculated as a function of its three dimensions. DOE

N80-15902# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report
W. J. Maraman, comp. Aug. 1979 44 p
(Contract W-7405-eng-36)
(LA-7980-PR) Avail: NTIS HC A03/MF A01

The use of $Pu(-238)O2$ in radioisotopic power systems is discussed. The three programs involved are the following: (1) general-purpose heat source development; (2) space nuclear safety; and (3) radioisotopic terrestrial safety. DOE

N80-15903# Battelle Human Affairs Research Centers, Seattle, Wash.
PUBLIC POLICY ISSUES IN NUCLEAR WASTE MANAGEMENT
S. M. Nealy and L. M. Radford Oct. 1978 98 p refs
(Contract EW-78-C-06-1076)
(PNL-2743) Avail: NTIS HC A05/MF A01

Issues analyzed include temporal equity; geographic and socioeconomic equity; implementation of a nuclear waste management system; and public involvement. DOE

N80-15904# California Univ., Berkeley. Lawrence Berkeley Lab.
ANGULAR MOMENTUM AND THE COLLECTIVE MODES EXCITED IN DEEP-INELASTIC PROCESSES AND IN FISSION
L. G. Moretto May 1979 20 p refs Presented at Conf. on Large Amplitude Collective Nucl. Motion, Lake Balaton, Hungary, 10 Jun. 1979
(Contract W-7405-eng-48)
(LBL-9173; CONF-790660-5) Avail: NTIS HC A02/MF A01

The angular momentum effects in deep inelastic processes and fission were studied in the limit of statistical equilibrium. The model consists of two touching liquid drop spheres. Angular momentum fractionation was found to occur along the mass asymmetry coordinate. Thermal excitation of fragment spin is predicted to occur in the degrees of freedom which can bear angular momentum, like wriggling, tilting, bending, and twisting. DOE

N80-15905# Los Alamos Scientific Lab., N. Mex.
RELATIVISTIC ELECTRON BEAM PROPAGATION: TWO-STREAM THEORY Progress Report, Jan. 1978 - Jan. 1979
B. S. Newberger Jul. 1979 48 p refs
(Contract W-7405-eng-36)
(LA-7912-MS) Avail: NTIS HC A03/MF A01

The two stream instability theory as it pertains to the propagation of relativistic electron beams through low pressure neutral gases is examined. A mathematical model is described which simulates both aspects of the stability issue: linear stabilization of the two stream mode and the nonlinear state of an unstable system. DOE

N80-15906# Oak Ridge National Lab., Tenn.
COMPATIBILITY OF STRUCTURAL MATERIALS WITH FUSION REACTOR COOLANT AND BREEDER FLUIDS
J. H. DeVan 1979 8 p refs Presented at 1st Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29 Jan. 1979
(Contract W-7405-eng-26)
(CONF-790125-77) Avail: NTIS HC A02/MF A01

Fusion reactors which are characterized by a lithium containing blanket, a heat transfer medium that is integral with the blanket and first wall, and a heat engine that couples to the heat transfer medium are described. A variety of lithium containing substances identified as potential blanket materials, including molten lithium metal, molten LiF-BeF2, Pb-Li alloys, and solid ceramic compounds such as Li2O are examined for use in fusion reactors. The materials factors that underlie the selection of workable combinations of blankets and coolants are studied and the materials compatibility problems generic to those blanket coolant combinations currently being considered in reactor design studies are discussed. DOE

N80-15907# Princeton Univ., N. J. Plasma Physics Lab.
FUSION-SUPPORTED DECENTRALIZED NUCLEAR ENERGY SYSTEM

D. L. Jassby Apr. 1979 29 p refs Presented at the Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract EY-76-C-02-3073)
(PPPL-1555; CONF-790803-36) Avail: NTIS HC A03/MF A01

A decentralized nuclear energy system using mass produced pressurized water reactors in the size range 10 to 300 MW (thermal) is evaluated. Attention is given to maximizing the refueling interval with no interim batch shuffling in order to minimize fuel transport, reactor downtime, and opportunity for fissile diversion. The requirement of a substantial fissile enrichment due to the above objectives is discussed with U-233 reported as the preferred fuel. Application of the neutral beam driven Tokamak fusion neutron source to a U-233 breeding pilot plant is examined. DOE

N80-15908# Sandia Labs., Albuquerque, N. Mex.
PULSED POWER FOR FUSION
T. H. Martin 1979 7 p refs Presented at the Pulsed Power Conf., Lubbock, Tex., 12 Jun. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0933C; CONF-790622-7) Avail: NTIS HC A02/MF A01

Research conducted in support of the pulsed power approach to fusion resulted in the creation of an extendable accelerator technology that could be used at levels up to 100 TW and 30 MJ. These types of accelerators are efficient (about 30 to 50 percent) and for ion outputs in the 1 to 3 MJ range they may provide an approach to economically feasible 200 MW electric power reactor. Repetitive pulsing of the pulsed power system for > 10 to the 9th power short lifetimes must be solved along with ion beam concentration, bunching, and drifting. DOE

N80-15909# Idaho National Engineering Lab., Idaho Falls.
ENVIRONMENTAL SURVEILLANCE REPORT FOR THE INEL RADIOACTIVE WASTE MANAGEMENT COMPLEX Annual Report, 1978
L. E. Adams, D. H. Janke, and P. T. Dickman Jun. 1979 56 p refs
(Contract EY-76-C-07-1570)
(TREE-1357) Avail: NTIS HC A04/MF A01

Data from and discussions about routine radiological monitoring of atmospheric, hydrologic, geologic, and biotic environments of the radioactive waste management complex (RWMC) are given. It is concluded that: (1) RWMC operations have not adversely affected local, existing environment; (2) environmental conditions within the transuranic storage area are not corrosive enough to adversely affect transuranic waste storage containers; and (3) the addition of lake bed soil to pit, trench, and soil test plot areas has altered the moisture cycle characteristic of RWMC soil. DOE

N80-15910# California Univ., Livermore. Lawrence Livermore Lab.
THERMAL-STRESS ANALYSIS OF ROCK FORMATIONS FOR NUCLEAR FUEL AND WASTE STORAGE
R. C. Greenlaw and M. A. Gerhard 11 Jun. 1979 30 p refs Presented at ADINA Conf., Cambridge, Mass., 1 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-81992; CONF-790627-2) Avail: NTIS HC A03/MF A01

The use of the computer programs ADINA and ADINAT for analysis of heat flow, temperature distribution, and underground stresses and deformations due to excavation and storage of nuclear fuel and/or waste canisters in hard rock formations is discussed. Successful and unsuccessful combinations of elements and properties for both the thermal and the stress analyses are determined. A discussion of code testing and verification of the programs is presented and an apparent error due to differences in the way in which ADINA interpolates the temperature and strain fields within each element is examined. DOE

N80-15911# California Univ., Berkeley. Lawrence Berkeley Lab.
ROCK MASS CHARACTERIZATION FOR STORAGE OF NUCLEAR WASTE IN GRANITE
P. A. Witherspoon, P. Nelson, T. Doe, R. Thorpe, B. Paulsson, J. Gale (Waterloo Univ., Ontario), and C. Forster (Waterloo Univ., Ontario) Feb. 1979 37 p refs Presented at the 4th Congr. of Intern. Soc. for Rock Mech., Montreux, Switzerland, 2-8 Sep. 1979
(Contract W-7405-eng-48)
(LBL-8570; SAC-18) Avail: NTIS HC A03/MF A01

The rock mass characterization in granite adjacent to an iron mine at Stripa, Sweden is described. The responses to thermal loading of jointed rock in situ, and mechanical tests on cores from 25 mm to 1 m in diameter are presented. Geological characterization included detailed surface mapping, subsurface mapping, and core mapping. Geophysical characterization used a variety of borehole techniques, with emphasis on sonic methods. The hydrologic characterization was done through injection tests, pump tests, water pressure measurements, and controlled inflow tests to tunnels. Mapping studies were useful in defining continuity and fracture system geometry. They did not give aperture, a factor significant in terms of both water flow and the displacements due to heating. Of the geophysical techniques, sonic methods were bound to be most effective in fracture definition. Hydrologic work yielded primarily aperture data, which with fracture geometry was used to calculate directional permeabilities. DOE

N80-15912# Los Alamos Scientific Lab., N. Mex.
SHALLOW LAND BURIAL: EXPERIENCE AND DEVELOPMENTS AT OAK RIDGE AND LOS ALAMOS
J. L. Warren 1979 35 p ref Presented at Intern. Symp. on Underground Disposal of Radioactive Wastes, Otaniemi, Finland, 2 Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1039; CONF-790711-1) Avail: NTIS HC A03/MF A01

Guidelines which regulate the construction of waste disposal facilities, burial and storage operations, disposal site maintenance and restoration, and documentation of all waste disposal activities are presented. Monitoring programs at the past and current solid waste disposal sites are discussed. DOE

N80-15913# South Carolina Univ., Columbia. Inst. of Archeology and Anthropology.
INTENSIVE ARCHEOLOGICAL SURVEY OF A POTENTIAL DEFENSE WASTE PROCESSING FACILITY SITE, SAVANNAH RIVER PLANT, AIKEN AND BARNWELL COUNTIES, SOUTH CAROLINA. RESEARCH MANUSCRIPT SERIES 149
R. D. Brooks and G. T. Hanson 1979 35 p refs
(Contract EW-78-S-09-1072)
(DOE/SR-01072-3) Avail: NTIS HC A03/MF A01

No archeological remains were uncovered in the proposed DWPF construction area. To assure preservation of any buried sites well beneath the present ground surface in the construction area, it is suggested that the Department of Energy arrange to have an archeologist monitor the excavation of the building sites for the DWPF. It is recommended that process be devised by which an archeologist makes daily checks of the spoil piles for archeological material. Regarding related construction on the periphery of the main construction area (e.g., roads, powerlines, waterlines), it is recommended that the triangle formed by the roads F, 4 and E be cleared for construction of any type for archeological purposes and that the archeologists be notified to monitor the construction for possible buried sites. Although the site 38AK261 is not considered to be significant to present or future research, it is recommended that an archeologist be notified when construction in that area is to take place in order to monitor any archeological materials uncovered. DOE

N80-15914# South Carolina Univ., Columbia. Inst. of Archeology and Anthropology.
INTENSIVE ARCHEOLOGICAL SURVEY OF A POTENTIAL INDEPENDENT SPENT FUEL STORAGE FACILITY, SAVANNAH RIVER PLANT, AIKEN AND BARNWELL COUNTIES, SOUTH CAROLINA. RESEARCH MANUSCRIPT SERIES 141
G. T. Hanson Dec. 1978 77 p refs
(Contract EW-78-S-09-1072)
(DOE/SR-01072-1) Avail: NTIS HC A05/MF A01

A complete inventory and evaluation of the archeological resources within the 550 acre parcel of the proposed ISFSF

area is presented. Eight previously unrecorded sites were found during the survey, with only one occuring within the main construction area. Three sites showed evidence of prehistoric occupations while the remaining sites were attributable to the historic period. Maps of the sites, the environmental setting, and the archeological background are discussed. DOE

74 OPTICS

Includes light phenomena.

N80-15915# Stanford Univ., Calif.
ACOUSTICALLY SCANNED OPTICAL IMAGING DEVICES Semiannual Report, 1 Jan. - 30 Jun. 1979
G. S. Kino, D. Behar, J. Bowers, B. Khuri-Yakub, and H. Olaisen
Aug. 1979 48 p refs
(Contract N00014-76-C-0129; ARPA Order 2778)
(AD-A074954; GL-3006; SAR-8) Avail: NTIS HC A03/MF A01 CSCL 09/5

A storage correlator has been operated for the first time as an inverse filter by operating in a feedback loop to iteratively converge via the LMS algorithm to the desired filter. A pulse and a ghost echo have been deconvolved to a single pulse with the sidelobe level 9 dB below the original echo level. The ZnO magnetron sputtering system is operating well; ZnO on Si convolvers have been constructed with better efficiency (-55 dBm) than any we have previously made. A -45 dBm efficiency Delta(v)/v waveguide convolver has been constructed. GRA

N80-15916# Texas A&M Univ., College Station. Dept. of Physics.
PHASE MATRIX MEASUREMENTS FOR ELECTROMAGNETIC SCATTERING BY SPHERE AGGREGATES
Jerold R. Bottiger, Edward S. Fry, and Randall C. Thompson
4 Sep. 1979 18 p refs
(Contract N00014-75-C-0537)
(AD-A074464; TR-2; Rept-2EX) Avail: NTIS HC A02/MF A01 CSCL 20/3

An instrument which permits accurate measurement of all elements of the phase matrix simultaneously has been constructed. Aggregates consisting of attached polystyrene spheres are suspended in an electric field and the phase matrix is measured. GRA

N80-15917# Ballistic Research Labs., Aberdeen Proving Ground, Md.
STATISTICS OF OPTICAL RADIATION SCATTERED FROM ROUGH SURFACES
Paul H. Deitz and Tommy E. Buder Jul. 1979 16 p
(DA Proj. 1L1-61102-AH-43)
(AD-A074351; AD-E430293; ARBRL-MR-02929) Avail: NTIS HC A02/MF A01 CSCL 20/6

When coherent illumination is scattered from a rough surface, the resulting pattern of light (speckle pattern) has stochastic variations in irradiance which relate to the scattering surface itself. A computer simulation for a particular scattering geometry has been made in which four statistical parameters of speckle patterns have been related to various pairwise combinations of surface height and correlation interval for a Gaussian scattering surface. The corresponding optical analogue of this simulation has potential application to studies of gun erosion. GRA

N80-15918# Arizona Univ., Tucson. Dept. of Physics.
DETERMINATION OF OPTICAL CONSTANTS FOR POWDERED MATERIALS IN THE 10 MICRON INFRARED REGION Final Report
Donald R. Huffman 3 Sep. 1979 62 p refs
(Contract N00019-78-C-0479)
(AD-A074465) Avail: NTIS HC A04/MF A01 CSCL 20/6

In order to successfully tailor the aerosol to the specific need we should be able to engineer the optical properties of the particulates, that is to calculate the performance of various systems and to produce the one that most closely fits the desired characteristics. In order to accomplish this optical engineering of aerosols the following two things are necessary: (1) a catalogue of the wavelength-dependent optical constants for various solids and liquids; and (2) adequate theoretical representation of how extinction is related to such factors as particle size, shape, and coatings. GRA

N80-15919# Stanford Univ., Calif. Edward L. Ginzton Lab.
ACOUSTIC MICROSCOPY AT CRYOGENIC TEMPERATURES Annual Summary Report, 1 Jul. 1978 - 30 Jun. 1979
C. F. Quate and J. Heiserman Sep. 1979 20 p refs
(Contract N00014-77-C-0412)
(AD-A074502; SU-GL-3008) Avail: NTIS HC A02/MF A01 CSCL 20/6

We report progress in work on a cryogenic acoustic microscope. Results in liquid argon and nitrogen at about 4300 angstrom wavelength are discussed. Images of gratings and integrated circuits are presented as examples of resolution and contrast. Work on producing effective matching layers to improve acoustic power transfer between solids and helium is summarized. Finally we present images taken in superfluid helium held at 1.95 degrees K. A wavelength of 3900 angstrom was attained, the shortest wavelength ever achieved in an acoustic microscope. GRA

N80-15920# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RESTORATION OF SPECKLE IMAGES
Jae S. Lim and Hamid Nawab 3 Jul. 1979 29 p refs
(Contracts F19628-78-C-0002; N00014-75-C-0951; AF Proj. 649L)
(AD-A074626; TN-1979-52; ESD-TR-79-167) Avail: NTIS HC A03/MF A01 CSCL 20/6

In this report, several techniques to reduce speckle noise (more generally signal independent multiplicative noise) in images are studied. The techniques include gray scale modification, frame averaging, low-pass filtering in the intensity and density domain, and application of the short space spectral subtraction image restoration technique in the density domain. Some discussions on the theoretical basis of the techniques studied are given and their performances are illustrated by way of examples. GRA

N80-15921# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
RAY AND WAVE OPTICS OF INTEGRABLE AND STOCHASTIC SYSTEMS
S. W. McDonald and A. N. Kaufman Jul. 1979 11 p refs
Presented at the Intern. Workshop on Intrinsic Stochasticity in Plasmas, Cargese, Corsica, France, 18 Jun. 1979
(Contract W-7405-eng-48)
(LBL-9465; CONF-7906106-1) Avail: NTIS HC A02/MF A01

The generalization of WKB methods to more than one dimension is discussed in terms of the integrability or non-integrability of the geometrical optics (ray Hamiltonian) system derived in the short-wave approximation. In the two-dimensional case the ray trajectories are either regular or stochastic, and the qualitative differences between these types of motion are manifested in the characteristics of the spectra and eigenfunctions. These are examined for a model system which may be integrable or stochastic, depending on a single parameter. DOE

N80-15922# Texas A&M Univ., College Station. Dept. of Physics.
MEASUREMENT OF POLARIZED LIGHT SCATTERING VIA THE MUELLER MATRIX
Randall C. Thompson, Jerold R. Bottiger, and Edward S. Fry
4 Sep. 1979 45 p refs
(Contract N00014-75-C-0537)
(AD-A074431; TR-3) Avail: NTIS HC A03/MF A01 CSCL 20/6

A new instrument for rapid and accurate measurement of the Mueller matrix is described. Distinct measurements of all sixteen elements are made simultaneously and with an absolute accuracy of 1 percent to 5 percent. The instrument employs electro-optic modulators. Results are presented for several simple optical devices and systems. GRA

N80-15923# National Center for Atmospheric Research, Boulder, Colo.

MIE SCATTERING CALCULATIONS, ADVANCES IN TECHNIQUE AND FAST, VECTOR-SHAPED COMPUTER CODES

Warren J. Wiscombe Jun. 1979 98 p refs
(PB-301388/5; NCAR-TN-140+STR) Avail: NTIS HC A05/MF A01 CSCL 20F

Two MIE scattering codes are presented. The first, MIEVO, attains as much vector speed as possible using the minimum possible memory and is suitable for almost any computer, whether or not it has vector capabilities. The second, MIEV1, attains maximum vector speed at the expense of using more money than MIEVO. It is most suitable for vector-processing computers. MIEV1 is from 10 percent to 300 percent faster on the CRAY-1 than MIEVO. GRA

N80-15924# National Technical Information Service, Springfield, Va.

FIBER OPTICS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1977 - Aug. 1979

Brian Carrigan Oct. 1979 227 p Supersedes NTIS/PS-78/0714; NTIS/PS-77/0581; NTIS/PS-76/0490; NTIS/PS-75/420; COM-74-10869
(NTIS/PS-79/1006/0; NTIS/PS-78/0714; NTIS/PS-77/0581; NTIS/PS-76/0490; NTIS/PS-75/420; COM-74-10869) Avail: NTIS HC $28.00/MF $28.00 CSCL 20F

Federally-funded research is cited on design, theory, fabrication, performance, and testing of fiber optical materials, components, and systems. Research on cables, transmission lines, waveguides, couplers, connectors, and lasers is covered. Fiber optics application in optical communications, data transmission systems, signal processing, display systems, integrated optical circuits, measuring instruments, detectors, avionics, fire control systems, recording systems, and underwater communications are included. Symposia are also cited. This updated bibliography contains 219 abstracts, 116 of which are new entries to the previous edition. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.

N80-15925# Villanova Univ., Pa. Dept. of Electrical Engineer.

INVESTIGATION OF MICROWAVE CIRCUITS THAT ARE SUITABLE FOR APPLICATION TO INTEGRATE WITH THE PRASAD-LEIBYS' PLASMA MILLIMETER WAVE TUBE

Hsu Tse-Wen 15 Sep. 1979 116 p refs
(Grant AF-AFOSR-3664-78)
(AD-A074988; AFOSR-79-1046TR) Avail: NTIS HC A06/MF A01 CSCL 09/1

It is the purpose of this research study to investigate theoretically several microwave circuits which are suitable to integrate with a beam-plasma millimeter wave tube, and the problems associated with them. Three microwave structures have been studied: (1) The hollow dielectric tube waveguides. (2) The cylindrical metal waveguide partially filled with a coaxial dielectric tube, and (3) The hollow dielectric tube waveguide supported by a conducting cylinder. They all employ dielectric tube as their basic element, and they all operate in the circularly symmetric transverse electric modes. The field problems have been solved and the resulting transcendental mode equations are solved graphically in conjunction with their respective dispersion relations. It is found that a critical frequency exists for all three structures, and below which no propagation waves can take place. As a circuit element or cavity both types I and II structures are shown to have the very desirable property of confining, and re-directing the emitted electromagnetic radiation from the plasma tube. Both of these structures are capable of single mode operation at very short wavelengths. It is a surprise to find that when type II structure is operated at the very high frequency mode, the structure behaves as if it is a dielectric tube waveguide, limited on the outside by a conducting surface of the cylindrical metal wall, and on the inside by a medium of small dielectric constant. GRA

N80-15926# Naval Research Lab., Washington, D. C.

DEVELOPMENT OF IMPLODING LINER SYSTEMS FOR THE NRL LINUS PROGRAM Interim Report

P. J. Turchi, R. L. Burton, A. L. Cooper, R. D. Ford, and D. J. Jenkins 28 Sep. 1979 13 p refs
(RR011094I)
(AD-A075005; NRL-MR-4092) Avail: NTIS HC A02/MF A01 CSCL 20/9

For nearly two decades, the idea of creating fusion plasmas by the implosion of cylindrical shells or liners has appealed to workers interested in high energy density systems. A variety of schemes have been offered over the years to accomplish the adiabatic compression of plasmas at megagauss magnetic field levels by imploding liner magnetic flux compression techniques. The two main elements of such schemes have been the implosion of an electrically conducting cylindrical liner and the creation of an initial plasma suitable for compression by the surrounding liner. Some progress has been made both experimentally and conceptually in regard to plasmas that could be compressed by liner implosion, but no experimental test has yet been accomplished successfully in which the energy and temperature of the magnetically-confined plasma has been increased into a significant regime by liner implosion. Considerable progress has been made, however, in developing liner implosion techniques suitable for both experimental development and eventual imploding liner fusion reactors. The principal development has been the achievement of controlled, reversible liner implosions with excellent symmetry and surface quality. This paper reviews some of the highlights of the development of liner implosion systems at the Naval Research Laboratory and indicates directions of future work. GRA

N80-15927# Michigan Univ., Ann Arbor.

ANALYSIS OF THE EARLY PHASE OF TOKAMAK PLASMA OHMIC HEATING

E. vonValtier Apr. 1979 92 p refs Prepared for Westinghouse Electric Corp., Pittsburgh
(Contract EG-77-C-02-4231)
(WFPS-TME-79-018) Avail: NTIS HC A05/MF A01

Ohmically heated Tokamak systems were studied in which the evolution of the plasma is followed through the initiation period up to 100 eV. A zero dimensional model of the bulk plasma is utilized, with a one dimensional model of the plasma inductance. Losses due to ionization and oxygen impurity processes are evaluated using the available atomic data. The total ohmic heating system energy expended in forming and heating the plasma up to a reference temperature of 100 eV is calculated and found to be a function of the maximum induced loop voltage. DOE

N80-15928# California Univ., Livermore. Lawrence Livermore Lab.

ENERGY COUPLING IN THE PLASMA FOCUS

T. E. Wainwright, W. L. Pickles, H. L. Sahlin, and D. F. Price 23 Apr. 1979 14 p refs Presented at 2nd Intern. Conf. on Energy Storage, Compression and Switching, Venice, 5 Dec. 1979
(Contract W-7405-eng-48)
(UCRL-81907; CONF-781247-4) Avail: NTIS HC A02/MF A01

A 125 kJ plasma focus was used to investigate mechanisms for rapid coupling of inductively stored energy into plasmas. The coupling which takes place through the formation of an electron or ion beam that deposits its energy in a target or directly by the penetration of the magnetic field into a resistive plasma is discussed. Some preliminary results from experiments of both types are described. The experiments use a replaceable conical anode tip that is intended to guide the focus to within a few millimeters of the axis, where it can suddenly deliver energy either to a small target or to particles that are accelerated. X-ray and fast ion diagnostics were used to study the effects. DOE

N80-15929# California Univ., Berkeley. Lawrence Berkeley Lab.

EQUILIBRIUM AND STABILITY IN STRONGLY INHOMOGENEOUS PLASMAS Ph.D. Thesis

H. E. Mynick Oct. 1978 222 p refs

(Contract W-7405-eng-48)
(LBL-8528) Avail: NTIS HC A10/MF A01

The equilibrium of strongly inhomogeneous, collisionless, slab plasmas, was studied. A generalized version of a formalism previously developed, which permits the generation of self consistent equilibria, for plasmas with arbitrary magnetic shears, and variation of magnetic field strength was used. A systematic procedure was developed for deriving the form of the guiding center Hamiltonian K, for finite eta, in an axisymmetric geometry. An expression for the first adiabatic invariant (the gyroaction) was derived. A formalism was developed for the study of the stability of strongly inhomogeneous, magnetized slab plasmas and applied to the ion drift cyclotron instability. DOE

N80-15930# California Univ., Davis. Dept. of Mechanical Engineering.
RESEARCH ON THE HYLIFE LIQUID-FIRST-WALL CONCEPT FOR FUTURE LASER FUSION REACTORS Final Report, Sep. 1977 - Mar. 1979
M. A. Hoffman Mar. 1979 40 p refs
(Contract W-7405-eng-48)
(UCRL-15033; FR-4) Avail: NTIS HC A03/MF A01

Protection of the structural walls of a laser fusion reactor with a curtain or wall of liquid lithium jets is examined. Planar sheet water jets issuing vertically downward from slit nozzles are evaluated for this application. The nozzles were subjected to forced harmonic excitation to simulate the vibrational environment of the laser fusion reactor, and experiments were run at both 1 atm and 0.2 atm pressure. Linear temporal stability theory is shown to predict the onset of the unstable regime and the spatial growth rates reasonably well for the cases where the amplitudes of the nozzle excitation are not too large and the waveform is nearly sinusoidal. DOE

N80-15931# Los Alamos Scientific Lab., N. Mex.
PARAMETRIC STUDY OF THE TORMAC FUSION REACTOR CONCEPT
R. L. Miller, R. A. Krakowski, and C. G. Bathke Aug. 1979 62 p refs
(Contract W-7405-eng-36)
(LA-7935-MS) Avail: NTIS HC A04/MF A01

A preliminary power balance for the D-T tormac magnetic fusion reactor concept is examined parametrically in order to establish general scaling relationships, tradeoffs, and constraints. The results are based on the simplifying assumptions of steady state operation, a homogeneous plasma, and ideal thin sheath, mirror-like confinement. Crucial physics uncertainties requiring further theoretical and experimental research attention were identified. Representative reactor physics operating points are generated to illustrate anticipated tormac reactor embodiments. DOE

N80-15932# Illinois Univ., Urbana.
MONTE CARLO SIMULATION OF NEUTRAL-BEAM INJECTION FOR MIRROR FUSION REACTORS Ph.D. Thesis
R. L. Miller 1979 153 p refs
(Contract EY-76-S-02-2218)
(COO-2218-133) Avail: NTIS HC A08/MF A01

Computer simulation techniques using the Monte Carlo method are developed for application to the modeling of neutral-beam injection into mirror-confined plasmas of interest to controlled thermonuclear research. The energetic neutral-beam particles interact with the target plasma through electron-atom and ion-atom collisional ionization as well as ion-atom charge-transfer collisions to give a fractional trapping of the neutral beam and a loss of charge-transfer-produced neutrals which escape to bombard the reactor first wall. Appropriate interaction cross sections for these processes are calculated for the assumed anisotropic, non-Maxwellian plasma ion phase-space distributions. DOE

N80-15933# California Univ., Livermore. Lawrence Livermore Lab.
SUPERCONDUCTIVITY FOR MIRROR FUSION
C. D. Henning Sep. 1978 23 p Presented at Appl. Superconductivity Conf., Pittsburgh, 25 Sep. 1978
(Contract W-7405-eng-48)
(UCRL-81693; CONF-780952-39) Avail: NTIS HC A02/MF A01

The use of mirror magnets in fusion reactors due to the high and steady magnetic fields they generate and the capacity to negate pulsed field is discussed. The past and present development of mirror magnets is reviewed and mirror fusion experiments are reported. A.W.H.

N80-15934# Los Alamos Scientific Lab., N. Mex.
GLOBAL PROPERTIES OF OHMICALLY HEATED REVERSED-FIELD PINCHES
R. A. Gerwin 1979 13 p refs
(Contract W-7405-eng-36)
(LA-UR-79-2344) Avail: NTIS HC A02/MF A01

The simultaneous requirements of power balance and pressure balance are considered in ohmically heated reversed field pinches. The treatment generalizes the Pease-Braginskii pinch current limit by including toroidal magnetic field, anomalous resistivity, nonradiative losses, and time dependent fields. The rise of the temperature to a state of power balance is discussed. The practical parameter windows implied by the joint action of power balance and pressure balance are displayed. DOE

N80-15935# California Univ., Los Angeles.
OBSERVATION OF STIMULATED BRILLOUIN SCATTERING IN A MICROWAVE PLASMA INTERACTION EXPERIMENT
H. E. Huey, E. Masz, and N. C. Luhmann, Jr. Jul. 1979 13 p refs
(Contract EY-76-C-03-0010)
(PPG-422) Avail: NTIS HC A02/MF A01

Stimulated Brillouin scattering of microwave radiation is investigated in an underdense laboratory plasma. The energy and momentum selection rules are seen to be satisfied for a variety of incident wavelengths and ion species (He, Ne, Ar and Kr). The threshold power, growth rate, and scattered power appear to be consistent with the finite interaction length theory. Saturation of the backscatter is observed and compared with existing theories. DOE

N80-15936# Princeton Univ., N. J. Plasma Physics Lab.
THEORY OF DRIFT-WAVE EIGENMODES IN TOROIDAL PLASMAS
L. Chen and C. Z. Cheng Jul. 1979 37 p refs
(Contract EY-76-C-02-3073)
(PPPL-1562) Avail: NTIS HC A03/MF A01

The eigenmode equation describing ballooning drift waves in toroidal plasmas is analyzed using the WKB method. Two branches of eigenmodes are identified. One is slab like and the other is a branch induced by the finite toroidicity. The slab like eigenmodes correspond to unbounded states and experience finite shear damping. The toroidicity induced eigenmodes correspond to local quasibounded states with negligible shear damping. Corresponding analytical theories are presented. DOE

N80-15937# Los Alamos Scientific Lab., N. Mex.
PHYSICAL CONDITIONS IN REVERSED FIELD PINCHES AND THETA PINCHES AS INFERRED FROM SIMULATIONS
A. Sgro 1979 14 p refs Presented at Intern. School of Plasma Phys., Varenna, Italy, 27 Aug. - 8 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2368) Avail: NTIS HC A02/MF A01

The nature of the transport in certain pinches is investigated by comparing experimental data with computational predictions of the AURORA code. The presence of anomalous resistivity and anomalous thermal conduction during the implosion phase of the ZT-S reversed field pinch is examined. Evidence is presented indicating that a low density wall emitted plasma occupies the region between the main plasma column and the wall. Simulations of a theta pinch show that anomalous heating of the ions due to microturbulent fields makes a noticeable contribution to the ion energetics. DOE

N80-15938# California Univ., Livermore. Lawrence Livermore Lab.
NEAR AND LONG TERM PULSE POWER REQUIREMENTS FOR LASER DRIVEN INERTIAL CONFINEMENT FUSION
W. L. Gagnon 12 Jun. 1979 24 p refs Presented at the

2nd IEEE Intern. Pulsed Power Conf., Lubbock, Tex., 12-14 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82661; CONF-790622-22) Avail: NTIS HC A02/MF A01

The development of large, ND:glass laser systems in order to address the basic physics issues associated with light driven fusion targets is discussed. The development of lasers as drivers for fusion power plants which exhibit higher efficiencies and shorter wavelengths is reported. The pulse power technology which was developed to meet the near and far term needs of the laser fusion program is evaluated. A.W.H.

N80-15939# California Univ., Livermore. Lawrence Livermore Lab.
PLASMA CROWBARS IN CYLINDRICAL FLUX COMPRESSION EXPERIMENTS
L. J. Suter 18 May 1979 28 p refs Presented at the 2d Intern. Conf. on Megagus Magnetic Field Generation and Related Topics, Washington, D.C., 29 May - 1 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82142; CONF-790540-13) Avail: NTIS HC A03/MF A01

A series of one and two dimensional calculations of hard core zeta pinch flux compression experiments, to study the effect of a plasma on these systems, are discussed. These calculations show that including a plasma can reduce the amount of flux lost during the compression. Flux losses to the outer wall of such experiments and flux which is lost into the center conductor are discussed. The effect of a plasma conducting sheath on the flux loss for each case is reported. DOE

N80-15940# Los Alamos Scientific Lab., N. Mex.
STATISTICAL THEORY OF LANGMUIR TURBULENCE
D. F. DuBois, H. A. Rose, and M. V. Goldman (Colorado Univ., Boulder) 1979 8 p refs Presented at the 14th Conf. Intern. sur les phenomenes d'ionisation dans les gaz, Grenoble, France, 9 Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-576; CONF-790708-1) Avail: NTIS HC A02/MF A01

A statistical theory of Langmuir turbulence is presented. The theory is developed by applying a generalization of the direction interaction approximation of Kraichnan to the Zakharov equations describing Langmuir turbulence. DOE

N80-15941# Princeton Univ., N. J. Plasma Physics Lab.
ITERATIVE METRIC METHOD FOR SOLVING THE INVERSE TOKAMAK EQUILIBRIUM PROBLEM
J. Delucia, S. C. Jardin, and A. M. M. Todd Jul. 1979 51 p refs
(Contract EY-76-C-02-3073)
(PPPL-1564) Avail: NTIS HC A04/MF A01

A method is presented for solving the toroidal magnetohydrodynamic equilibrium equation in a coordinate system based on the magnetic field lines. Both fixed boundary (conducting shell) and free boundary (external coil) boundary conditions are considered. A comparison with a special analytic solution is made. DOE

N80-15942# Argonne National Lab., Ill.
TECHNICAL SUPPORT FOR OPEN-CYCLE MHD PROGRAM Progress Report, Apr. - Jun. 1978
D. H. Bomkamp, ed. Jul. 1979 76 p ref
(Contract W-31-109-eng-38)
(ANL/MHD-78-11) Avail: NTIS HC A05/MF A01

The analysis of a magnetohydrodynamic/steam system is discussed. The major components of the system are examined including the combustor, the nozzle channel diffuser, the slag separator, and the high temperature air heaters. The development of a model for the heat transfer and slag flow and a model to estimate the effective emissivities and absorptivities of coal combustion gas containing slag droplets are discussed. A.W.H.

N80-15943# Oak Ridge National Lab., Tenn.
MATERIALS EXPERIENCE WITH TOKAMAK PLASMAS
R. J. Colchin 1979 6 p refs Presented at the Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29 Jan. 1979
(Contract W-7405-eng-26)
(CONF-790125-54) Avail: NTIS HC A02/MF A01

The primary effects of using various wall and limiter materials are examined in relation to the amount and kind of impurities they introduce into the plasma. The materials tested and discussed include gold, stainless steel, inconel, glass, alumina, and titanium for first walls and carbon; stainless steel, inconel, alumina, silicon carbide, boron carbide, molybdenum, tantalum, titanium, and tungsten for limiters and diverters. DOE

N80-15944# California Univ., Livermore. Lawrence Livermore Lab.
STOCHASTIC MOTION OF PARTICLES IN MIRROR MACHINES
R. H. Cohen 15 Jun. 1979 12 p refs
(Contract W-7405-eng-48)
(UCRL-82481) Avail: NTIS HC A02/MF A01

Applications of stochasticity theory to particle motion in quiescent mirror machines are discussed. The problem of magnetic moment jumps in a conventional mirror machine, and the role of stochasticity in extending the mirror loss cone are reviewed. Magnetic moment jumps in a flat bottomed magnetic well, such as the solenoid of a tandem mirror machine are examined. The motion of guiding centers in a nonaxisymmetric tandem mirror solenoid are studied. DOE

N80-15945# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
TWO-STREAM INSTABILITY FOR A SCATTERED BEAM PROPAGATING IN A COLLISIONAL PLASMA
B. S. Newberger and L. E. Thode 1979 9 p refs Presented at the Intern. Topical Conf. on High Powered Electron and Ion Beam Research and Technology, Novosibirsk, (USSR), 3 Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1687; CONF-790723-2) Avail: NTIS HC A02/MF A01

Significant progress was made in the understanding of the collisional stabilization of the high-frequency two-stream instability in a relativistic electron beam through a rigorous Vlasov treatment. Substantially different scaling with parameters are obtained in comparison with previous, essentially phenomenological, models and we have gained insight into the mechanism of the stabilization process. Further investigation of the 2D case remains to be done. The issue of stabilization of the two-stream instability in finite geometry is as yet unexplored as is that of nonlinear saturation, by trapping, of the instability in the presence of momentum spread on the beam and collision on the plasma electrons. These are important in the application of relativistic electron beams to the heating of dense plasmas and possibly in the interpretation of neutral gas propagation experiments. Extension of our research into these areas will necessarily rely on the investigations outlined above. DOE

N80-15946# General Accounting Office, Washington, D. C. Energy and Minerals Div.
FUSION: A POSSIBLE OPTION FOR SOLVING LONG-TERM ENERGY PROBLEMS
28 Sep. 1979 60 p
(PB-300692/1; EMD-79-27) Avail: NTIS HC A04/MF A01 CSCL 18A

The concepts of nuclear fusion and the nuclear fusion reactor are reviewed. The topics addressed are plasma confinement, fusion-fission hybrid reactors, and thermonuclear power generation. A.W.H.

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-15947# Electronics Research Lab., Adelaide (Australia).
LIQUID PHASE EPITAXIAL GROWTH OF GALLIUM ARSENIDE
M. Folkard Jul. 1979 37 p refs

(AR-001-668; ERL-0078-TR) Avail: NTIS HC A03/MF A01

Two methods of liquid phase epitaxial (LPE) growth were applied to the compound semiconductor gallium arsenide, and a mathematical description for each was developed using a diffusion-limited model. The properties of the epitaxial layers grown under various experimental conditions are discussed, and the observed growth rates compared with those predicted by the mathematical models. From the differences observed, it is concluded that processes additional to simple diffusion of solute through the melt are occurring. Convective mixing caused by horizontal temperature gradients within the melt is suggested as an explanation for these differences. A.R.H.

N80-15948*# McDonnell-Douglas Research Labs., St. Louis, Mo.

ADVANCED METHODS FOR PREPARATION AND CHARACTERIZATION OF INFRARED DETECTOR MATERIALS Quarterly Progress Report, 5 Jun. - 4 Sep. 1979

S. L. Lehoczy Sep. 1979 23 p refs

(Contract NAS8-33107)

(NASA-CR-161352) Avail: NTIS HC A02/MF A01 CSCL 20B

Crystal growth of Hg sub 1-x Cd sub x Te and density measurements of ingot slices are discussed. Radial compositional variations are evaluated from the results of infrared transmission edge mapping. The pseudo-binary HgTe-CdTe phase diagram is examined with reference to differential thermal analysis measurements. The phase equilibria calculations, based on the 'regular association solution' theory (R.A.S.) are explained and, using the obtained R.A.S. parameters, the activities of Hg, Cd, and Te vapors and their partial pressures over the pseudo-binary melt are calculated. M.G.

N80-15949# Brown Univ., Providence, R. I. Dept. of Chemistry.

ELECTRICAL AND OPTICAL PROPERTIES OF HIGH PURITY P-TYPE SINGLE CRYSTALS OF GeFe2O4

Pierre Strobel, Frank P. Koffyberg, and Aaron Wold Sep. 1979 26 p refs Submitted for publication

(Contract N00014-77-C-0387; Grant NSF GF-39737)

(AD-A073998; TR-7) Avail: NTIS HC A03/MF A01 CSCL 09/1

Single crystals of the spinel GeFe2O4, grown by the chemical vapor transport technique, are p-type semiconductors with an acceptor ionization energy of 0.39 eV. The material is a heavily compensated band-type semiconductor, with a typical hole concentration of 3/10 to the 14 power cm near room temperature, and a temperature independent Hall mobility of 2 sq cm/Vs. Optical absorption measurements show the optical band gap to be 2.3 eV; the octahedral field splitting of the Fe(2-) d-levels is 10200 1/10200 cm. Magnetic measurements show that nieff) is 5.26, from which a trigonal field splitting of 1/950 cm is derived. GRA

N80-15950# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 Feb. - 30 Apr. 1979

Alan J. McLaughlin and Alan L. McWhorter 15 May 1979 19 p

(Contract F19628-78-C-0002; AF Proj. 649L)

(AD-A074083; ESD-TR-79-74) Avail: NTIS HC A02/MF A01 CSCL 20/12

This Quarterly Technical Summary covers the period 1 February through 30 April 1979. It consolidates the reports of Division 2 (Data Systems) and Division 8 (Solid State) on the Advanced Electronic Technology Program. GRA

N80-15951# Mission Research Corp., La Jolla, Calif.

NEUTRON HARDNESS ASSURANCE GUIDELINES FOR SEMICONDUCTOR DEVICES Contractor Report, Jul. 1979

Robert A. Berger Sep. 1979 103 p refs

(Contract DAAK21-79-M-3448)

(AD-A074882; MRC-SD-R-36; HDL-CR-79-0448) Avail: NTIS HC A06/MF A01 CSCL 20/12

This guideline document develops a systematic approach to guarantee system survival at some specified probability of survival and neutron environmental level. The approach is analogous to a filtering process in which increasingly complex and costly levels of effort are applied until all system piece-parts have acceptable probabilities of survival. Branch decisions in the procedure are based on a statistical evaluation of manufacturer-to-manufacturer and lot-to-lot variations in piece-part neutron responses. Hardness assurance is part of the total quality assurance effort and includes all control, monitoring, and evaluation efforts needed to procure systems whose nuclear hardness equals or exceeds that of the design-hardened engineering prototype throughout production and system life. Hardness assurance efforts during the production phase are made part of the piece-part procurement specification. Example procurement specifications are given in this document for bipolar transistors, diodes, transistor-transistor logic integrated circuits, operational amplifiers (101A, 741, and 108A types), and junction-field effect transistors. GRA

N80-15952# North Texas State Univ., Denton. Dept. of Physics.

OPTICALLY INDUCED HOT ELECTRON EFFECTS IN SEMICONDUCTORS Summary Report, 1 Sep. 1978 - 31 Aug. 1979

Arthur L. Smirl 1 Jun. 1978 194 p refs

(Contract N00014-76-C-1077)

(AD-A073920) Avail: NTIS HC A09/MF A01 CSCL 20/12

We report our progress in using the high electric fields and ultrashort pulses from mode-locked lasers to study the temporal evolution of the saturable optical properties of semiconductors on a picosecond time scale. In these studies, the excite and probe technique is employed to obtain information concerning the ultrafast dynamics of photogenerated electron-hole plasmas. Germanium has been chosen for the initial investigations since its bandgap energy is comparable to but less than the photon energy of the Nd: glass lasers. GRA

N80-15953# Illinois Univ. at Chicago Circle, Chicago. Dept. of Physics.

TOPOGRAPHIC EXAMINATION OF SEMICONDUCTOR SYSTEMS Annual Technical Report, 1 Jun. 1978 - 30 Jun. 1979

R. L. Brown, S. Sundaram, and P. M. Raccah Jul. 1979 58 p refs

(Contract N00173-78-C-0437)

(AD-A075007) Avail: NTIS HC A04/MF A01 CSCL 20/12

Using the electrolyte electroreflectance (EER) technique, a systematic characterization of GaAs and InP as well as quaternary alloy InGaAsP has been made. Those materials grown at the Naval Research Laboratory include unimplanted samples and those implanted with Be, Se, and Si ions. Besides topographic examination of uniformity of carrier concentration, the spectra have been analyzed and effects of implantation and anneal procedures on the transition energies have been examined. The results of characterization have been provided as feed back information for the materials growth program at NRL. The EER technique is shown to be an unusually sensitive tool in the characterization of these semiconducting materials. GRA

N80-15954# Applied Electronic Research Corp., Gainesville, Fla.

TWO-DIMENSIONAL AVALANCHE BREAKDOWN IN Pt-Si SCHOTTKY BARRIER DIODES Final Report

David P. Kennedy Griffiss AFB, N.Y. RADC Jul. 1979 146 p refs

(Contract F19628-77-C-0220; AF Proj. 2305)

(AD-A075010; RADC-TR-79-189) Avail: NTIS HC A07/MF A01 CSCL 20/12

The development of a two-dimensional computer model was undertaken for calculating avalanche breakdown in a Pt-Si Schottky barrier diode. A principal objective of this program was to develop such a computer program, and make the source-code and operational data available to other workers in the field. Further, as a means to verify the applicability of this program junction, breakdown computations were to be undertaken throughout a wide range of physical parameters and ambient temperatures. GRA

N80-15955# Oklahoma Univ., Norman. Dept. of Chemistry.

THE CRYSTAL STRUCTURE AND VARIABLE TEMPERATURE Sn-119m MOESSBAUER STUDY OF TRIMETHYLTIN GLYCINATE, A ONE-DIMENSIONAL, AMINO-BRIDGED POLYMER

B. Y. K. Ho, K. C. Molloy, J. J. Zuckerman, F. Reidinger, and J. A. Zubieta 4 Sep. 1979 34 p refs Submitted for publication
(Contract N00014-77-C-0432; NR Proj. 053-636)
(AD-A074383; TR-9) Avail: NTIS HC A03/MF A01 CSCL 11/9

The crystal structure of trimethyltin glycinate has been determined by Patterson Fourier techniques to a final 'R'-factor of 0.066 for 1103 unique reflections. The crystals are tetragonal with space group P41 or P43 with a = b = 7.839(9) and c = 14.659(11)Angstom, Z = 4, and are composed of stacks of linearly polymeric trimethyltin glycinate molecules bridged axially at tin through the amino nitrogen atoms of the amino acid. There is hydrogen bonding between carbonyl oxygen and amino group N-H moieties along the chains and between the chains to produce a perpendicular weave of one-dimensional polymer threads. GRA

N80-15956# Sandia Labs., Albuquerque, N. Mex.
AUGER LINESHAPE ANALYSIS OF MOLECULES AND SOLIDS
D. R. Jennison 1979 20 p refs Presented at the 26th Natl. Vacuum Symp., New York, 2 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1240C; CONF-791013-4) Avail: NTIS HC A02/MF A01

Core-valence-valence Auger lineshape analysis may often be successfully made in terms of the molecular orbital structure of the molecule or the band structure of the solid. This approach assumes a priori that the final state hole motion is uncorrelated. Limitations to this approach include the highly correlated final states observed in ionic and narrow band solids (as Cu). Complications to this approach include the initial state valence screening of the core hole which affects the Auger decay probabilities. However, much useful information about the local density of states (local chemical environment) may be extracted in covalent and metallic materials. Examples from molecular (CH4, C2H4, C2H6, C3H8, and H2O) and solid state (Cu and Be) spectra are presented and the state of understanding of lineshape analysis is summarized. DOE

N80-15957# Bendix Corp., Kansas City, Mo.
METHOD OF NORMALIZING THE MEASURED SCATTERED LIGHT FROM A SURFACE DEFECT LOCATED ARBITRARILY IN A GAUSSIAN INTENSITY DISTRIBUTION INCIDENT ON A SURFACE
P. E. Klingsporn Aug. 1979 31 p refs
(Contract EY-76-C-04-0613)
(BDX-613-2287) Avail: NTIS HC A03/MF A01

A method of normalization is described which makes direct use of the Gaussian intensity distribution of the TEM/sub infinity/mode. By this method, the amount of light scattered by a defect is normalized to the value which would be observed if the defect were located at the center of the beam, for a defect small in size compared with the 1/e to the second power diameter of the Gaussian profile. The normalization requires that three measurements be made of the scattering by the defect for an arbitrary location of the defect relative to the center of the beam. Experimental data is presented which verifies the theory. DOE

N80-15958# Los Alamos Scientific Lab., N. Mex.
HYDROGEN SCATTERING CROSS SECTION, 1H(n,n)1H
Leona Stewart Jul. 1979 17 p refs
(Contract W-7405-eng-36)
(LA-7899-MS) Avail: NTIS HC A02/MF A01

The status of the hydrogen scattering cross section is reviewed with particular emphasis on standards applications. The ENDF/B-V evaluation is described in detail and compared with experimental data. DOE

N80-15959# Oak Ridge National Lab., Tenn.
ITINERANT ELECTRON MAGNETISM IN 3D-TRANSITION METALS
J. F. Cooke May 1979 24 p refs Presented at Joint INTERMAG-MMM Conf., New York, N.Y., 17 Jul. 1979 Submitted for publication
(Contract W-7405-eng-26)
(CONF-790738-1) Avail: NTIS HC A02/MF A01

Inelastic neutron scattering experiments were performed on the 3 dimensional transition metal ferromagnets. Of particular importance was the disappearance of the spin wave mode above a certain cut off wave vector, the existence of the spin wave mode above a certain cut off wave vector and the existence of the spin waves well above the Curie temperature. At low temperatures, quantitative predictions of the itinerant electron theory calculations were found to be in excellent agreement with experiment. These calculations predicted the existence of an optical spin wave mode in nickel. DOE

N80-15960# Argonne National Lab., Ill.
FERMI SURFACE MEASUREMENTS IN A-15 COMPOUNDS
A. J. Arko, G. W. Crabtree, and Z. Fisk 1979 16 p refs Presented at Superconductivity in d and f-Band Metals, San Diego, Calif., 21 Jun. 1979 Prepared jointly with California Univ., San Diego, La Jolla
(Contract W-31-109-eng-38)
(CONF-790653-13) Avail: NTIS HC A02/MF A01

New dHvA data in Nb3Sb are presented and compared with the various band calculations. Progress of Fermi surface measurements in A-15 compounds in general is reviewed. DOE

N80-15961# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
OBTAINING NUMERICAL VALUES FOR THE ELLIPTIC EMISSION FUNCTIONS USED IN CALCULATING ELECTRON EMISSION FROM SURFACES
H. C. Miller 7 Sep. 1979 36 p refs
(Contract EY-76-C-04-0656)
(GEPP-TIS-443) Avail: NTIS HC A03/MF A01

The four elliptic emission functions v(y), t(y), s(y) and the ta(y) [or f/sub mg/(y)] are used in calculating electron emission from surfaces under the influence of temperature and external electric fields. Critical evaluations are made of the published tables of these functions. Several existing approximation equations for the emission functions are given together with some additional polynomial approximations. The estimated accuracies of these approximation equations range from five to six significant figures for the most complex approximations to + or -1% or so for the simplest. DOE

N80-15962# Arizona State Univ., Tempe. Dept. of Physics.
IMAGING OF SURFACES AND DEFECTS OF CRYSTALS Progress Report, 1 May 1978 - 30 Apr. 1979
J. M. Cowley Apr. 1979 18 p refs
(Contract EY-76-S-02-2995)
(COO-2995-3) Avail: NTIS HC A02/MF A01

The possibility of obtaining electron diffraction patterns from very small specimen regions combined with high resolution imaging by use of scanning transmission electron microscopy (STEM) allows the detailed study of small nuclei of reaction products or of crystal defects. The capabilities of this method were extended by the design and construction of a TV system for the viewing and recording of microdiffraction patterns from STEM so that clear patterns can be obtained from regions as small as 10A in diameter. This system was applied to the study of initial stages of oxidation of chromium films, revealing the presence of very small oxide nuclei and identifying these crystals as having a previously unsuspected spinel structure. Initial results were also obtained on the surface structure of oxides such as MgO. The imaging of crystal surfaces by the use of medium-to-low energy electrons (15 to 1 KeV) allowed a much more complete understanding of the contrast-producing mechanisms. Application to the study of pyrolytic graphite surfaces is discussed. DOE

N80-15963# Wisconsin Univ., Madison.
STIMULATED THOMSON SCATTERING Ph.D. Thesis
R. L. Spencer Mar. 1979 150 p refs
(Contract EY-76-S-02-2387)
(COO-2387-104) Avail: NTIS HC A07/MF A01

The theory of stimulated Thomson scattering is investigated both quantum mechanically and classically. Two monochromatic electromagnetic waves of like polarization travelling in opposite directions are allowed to interact for a time tau with the electrons

in a collisionless plasma. The electromagnetic waves have frequencies well above the plasma frequency, and their difference frequency is allowed to range upward from the plasma frequency. With the difference frequency well above the plasma frequency, the rate at which energy is transferred from one wave to the other is calculated quantum mechanically, classically from a fluid theory, and classically from an independent electron theory. The rate is calculated in both the homogeneously broadened limit, and in the inhomogeneously broadened limit. DOE

N80-15964# Sandia Labs., Albuquerque, N. Mex.
AIMS AND ACCOMPLISHMENTS OF SURFACE THEORY
P. J. Feibelman 1979 28 p refs Presented at 26th Natl. Vacuum Symp., New York, 2 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1150C; CONF-791013-1) Avail: NTIS HC A03/MF A01

Research on surface structure, transport and chemistry is presented. In order to develop a predictive capability regarding surface structure, a variety of intrinsic surface properties are being studied, including the nature of bonds at transition metal surfaces, the meaning of bond locality in extended systems, and the electronic factors underlying the forces which govern surface geometry. The main thrust of current work - empirical and predictive surface structure determination is considered. These points are illustrated with examples from recent research and ways in which experimental surface work might assist theoretical efforts are indicated. DOE

N80-15965# Sandia Labs., Albuquerque, N. Mex.
DIELECTRIC STRENGTH OF SiO2 IN A CMOS TRANSISTOR STRUCTURE
J. M. Soden 1979 7 p refs Presented at the Elec. Overstress/Electrostatis Discharge Symp., Denver, 25 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1715C; CONF-790936-1) Avail: NTIS HC A02/MF A01

The distribution of experimental dielectric strengths of SiO2 gate dielectric in a CMOS transistor structure is shown to be composed of a primary, statistically-normal distribution of high dielectric strength and a secondary distribution spread through the lower dielectric strength region. The dielectric strength was not significantly affected by high level (1 x 10 to the 6th power RADS (Si)) gamma radiation or high temperature (200 C) stress. The primary distribution breakdowns occurred at topographical edges, mainly at the gate/field oxide interface, and the secondary distribution breakdowns occurred at random locations in the central region of the gate. DOE

N80-15966# California Univ., Riverside.
LOCAL ELECTRONIC PROPERTIES OF DILUTE MAGNETIC ALLOYS Ph.D. Thesis
S. Yoksan Dec. 1978 114 p refs
(Contract EY-76-S-03-0034)
(SAN-0034-T4) Avail: NTIS HC A06/MF A01

Some local properties of dilute magnetic alloys are studied in the normal and the superconducting states. The effects of elastic and inelastic scattering are considered. It is found that near the transition temperature, the spatial variation of the superconducting order parameter around a single magnetic impurity at large distances has a characteristic 1/r dependence with an amplitude proportional to the depression of T/sub c/, whereas at short distances, the spatial dependence is of the form (a + bcos2k/sub f/r)/sq r + c/r. A microscopic calculation is presented for the host nuclear spin-lattice relaxation time in the presence of 3d-transition metal impurities in a host as a function of impurity-host distance. Two important mechanisms are considered; the relaxation due to the localized spin fluctuations, and the kinematic change because of the resonant scattering of conduction electrons. DOE

N80-15967# Oklahoma State Univ., Stillwater. Dept. of Physics.
ELECTRONIC STRUCTURE OF DEFECTS IN OXIDES Progress Report, 1 Dec. 1978 - 30 Nov. 1979
G. P. Summers 1979 24 p refs
(Contract EY-76-S-05-4837)
(ORO-4837-6) Avail: NTIS HC A02/MF A01

Models of the electronic structure of simple defects in oxides are discussed. The models are based on the following studies described: the optical absorption and emission near the band edge of SrO; radiation damage in MgAl2O4; the temperature dependence of fluorescence yield and lifetime of F-+ centers in SrO; and the temperature dependence of fluorescence from F centers in alpha-Al2O3. A.W.H.

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-15968# Illinois Univ. at Urbana-Champaign. Dept. of Physics.
ON 1/N EXPANSIONS AND THE PHASED DIAGRAM OF DISCRETE LATTICE GAUGE THEORIES WITH MATTER FIELDS
John B. Kogut Jan. 1980 42 p refs
(Grant NSF PHY-79-00272)
Avail: NTIS HC A03/MF A01

Ising lattice guage theory with matter fields is generalized to a family of gauge invariant N-state models. These models are soluble in the N yields infinity limit. In both two and three spatial dimensions, the N yields infinity limits of these models possess three phases separated by lines of first order transitions. One phase admits free charge, the second confines and the third experiences the Higgs phenomenon. The 1/N corrections are calculable and terminate the boundary between the confining and Higgs phases. A closed region of free charge persists for all N > or - 1. Author

N80-15969# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.
PHASE CHANGE HEAT CONDUCTION IN GENERAL ORTHOGONAL CURVILINEAR COORDINATES Final Report, 1967 - 1968
Leon Bledjian 15 Feb. 1979 50 p refs
(Contract F04701-78-C-0079)
(AD-A074896; TR-0079-4901-01-1; SAMSO-TR-79-81) Avail: NTIS HC A03/MF A01 CSCL 20/13

The approximate method of London and Seban for predicting the solidification rate and for melting in or around slabs, cylinders, and spheres has been reformulated in general orthogonal curvilinear coordinates. Closed-form solutions are presented for the rate of phase change and temperature drop as a function of a nondimensional time, STeFo (product of Stefan and Fourier numbers), for various geometries including elliptic cylinders, spheroids of varying eccentricites, and bicylindrical problems. Both convection and flux boundary conditions which can vary with time are considered. The effect of Biot number on phase change times and the resulting boundary temperature are presented in graphical form for some of the geometries considered. The method's degree of approximation is investigated by comparison with published analytical results. The approximate applicability of the equations to some special phase change conduction problems is demostrated. GRA

N80-15970# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
QUANTUM MECHANICS WITH APPLICATIONS TO QUARKONIUM
C. Quigg and J. L. Rosner Feb. 1979 77 p refs
(Contract EY-76-C-02-1764)
(COO-1764-360) Avail: NTIS HC A05/MF A01

Some methods of nonrelativistic quantum mechanics which are particularly useful for studying the variation of bound-state parameters with constituent mass and excitation energy are reviewed. These techniques rely upon elementary scaling arguments and on the semiclassical (WKB) approximation. They

are of general interest, but are applied here to the study of bound systems of a heavy quark and antiquark. Properties of the interquark interaction are extracted from information about masses and leptonic widths of the Psi and T families. It is shown how general methods can be applied to the determination of the electric charge of quarks and to the prediction of properties of new families. DOE

N80-15971# Massachusetts Inst. of Tech., Cambridge.
BIFURCATION AND STABILITY IN YANG-MILLS THEORY WITH SOURCES
R. Jackiw Jun. 1979 47 p refs
(Contract EY-76-C-02-3069)
(COO-3069-655) Avail: NTIS HC A03/MF A01

Recent work on solutions to classical Yang-Mills theory is dicussed. The investigations summarized include the field equations with static, external sources. A pattern allowing a comprehensive description of the solutions and stability in dynamical systems are covered. A list of open questions and problems for further research is given. DOE

N80-15972# Harvard Univ., Cambridge, Mass. Science Center.
INTEGRABILITY CONDITIONS FOR THE EXISTENCE OF A LAGRANGIAN IN NEWTONIAN MECHANICS AND FIELD THEORY Annual Progress Report, 1 Mar. 1978 - 31 May 1979
S. Sternberg and R. M. Santilli 1979 18 p refs
(Contract ER-78-S-02-4742)
(COO-4742-1) Avail: NTIS HC A02/MF A01

The principle of general covariance is considered as well as its application to particle motion and continuum mechanics. A method for microlocal analysis was developed and applied to integral geometry, geometric quantization, and the fine structure of spectra. The experimental verification of the validity or invalidity of Pauli's exclusion principle and other basic physical laws for the nuclear and hadronic structure was proposed. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-15973*# National Aeronautics and Space Administration, Washington, D. C.
DECISION MAKING AND PROBLEM SOLVING WITH COMPUTER ASSISTANCE
F. Krauss Jan. 1980 61 p refs Transl. into ENGLISH of "Entscheiden und Problemlorsen mit Rechneruntersteutzung", Rept. FB-36 Forschungsinstitut fuer Anthropotechnik, Meckenheim, West Germany, Feb. 1978 p 1-73 Original language document was announced as N79-28048 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASW-3199)
(NASA-TM-76008; FB-36) Avail: NTIS HC A04/MF A01 CSCL 05A

In modern guidance and control systems, the human as manager, supervisor, decision maker, problem solver and trouble shooter, often has to cope with a marginal mental workload. To improve this situation, computers should be used to reduce the operator from mental stress. This should not solely be done by increased automation, but by a reasonable sharing of tasks in a human-computer team, where the computer supports the human intelligence. Recent developments in this area are summarized. It is shown that interactive support of operator by intelligent computer is feasible during information evaluation, decision making and problem solving. The applied artificial intelligence algorithms comprehend pattern recognition and classification, adaptation and machine learning as well as dynamic and heuristic programming. Elementary examples are presented to explain basic principles. Author

N80-15974*# National Aeronautics and Space Administration, Washington, D. C.
RESEARCH AND TECHNOLOGY OBJECTIVES AND PLANS SUMMARY (RTOPS). RESEARCH AND TECHNOLOGY PROGRAM, FISCAL YEAR 1980
1980 201 p
(NASA-TM-80744) Avail: NTIS HC A10/MF A01 CSCL 05A

A compilation of the summary portions of each of the Research and Technology Objectives and Plans (RTOPS) used for management review and control research currently in progress throughout NASA is presented. Indexes include: subject, technical monitor, responsible NASA organization, and RTOP number. A.R.H.

N80-15975# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
LINEAR MULTIPLE OBJECTIVE PROBLEMS WITH INTERVAL COEFFICIENTS
Gabriel R. Bitran Aug. 1979 26 p refs
(Contract N00014-75-C-0556)
(AD-A073967; TR-167) Avail: NTIS HC A02/MF A01 CSCL 12/2

This paper considers linear multiple objective programs with coefficients of the criteria given by intervals. This class of problems is of practical interest since in many instances it is difficult to determine precisely the coefficients of the objective functions. A subproblem to test if a feasible extreme point is efficient in the problem considered is obtained. A branch and bound algorithm to solve the subproblem as well as computational results are provided. Extensions are discussed. GRA

N80-15976# National Technical Information Service, Springfield, Va.
MANAGEMENT BY OBJECTIVES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug. 1979
Mary E. Young Sep. 1979 93 p Supersedes NTIS/PS-78/0976; NTIS/PS-77/0892
(NTIS/PS-79/0958/3; NTIS/PS-78/0976; NTIS/PS-77/0892)
Avail: NTIS HC $28.00/MF $28.00 CSCL 05A

The bibliography cites studies relating to the philosophy of Management by Objectives (MBO) as well as positive and negative factors where MBO has been implemented. Case studies of implementation include health care planning, urban planning, local governments, housing, military management, R & D organizations, etc. This updated bibliography contains 85 abstracts, 19 of which are new entries to the previous edition. GRA

N80-15977# Washington State Univ., Pullman. College of Economics and Business.
A PROGRAM OF MANAGEMENT AND TECHNICAL ASSISTANCE IN THE STATE OF WASHINGTON Final Report
Gene Hansen Sep. 1979 132 p
(Grant EDA-07-06-01792-1)
(PB-299276/6; EDA-79-0139) Avail: NTIS HC A07/MF A01 CSCL 05A

A program to support economic growth of Washington by making the existing resources of Washington State University and other cooperating institutions accessible and by delivering competent management and technical assistance in support of specific economic development is discussed. Several exhibits are included. GRA

N80-15978# Little (Arthur D.), Inc., Cambridge, Mass.
FACTORS RELATED TO THE IMPLEMENTATION AND DIFFUSION OF NEW TECHNOLOGIES: A PILOT STUDY
Jun. 1979 126 p
(Grant NSF ERS-77-03286)
(PB-298998/6; ADL-80978; NSF/PRA-7703286) Avail: NTIS HC A07/MF A01 CSCL 05A

Case studies of 14 technologies were carried out in order

to develop an understanding of how government intervention affects the processes of implementation and diffusion of new technologies. The technologies studied were: automobiles, broadcast radio, frozen foods, black and white TV, color TV, polio vaccine, supersonic transport, fluoridation of water supplies, computer-aided instruction, basic oxygen process for steel, numerical control in manufacturing, digital computers, lasers, and integrated circuit. The key factors, their motivations for implementing/adopting the technology (or not doing so), the interactions among the key factors, and how these affected implementation/adoption are examined. GRA

N80-15979# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.

SCHEDULING OF FLEXIBLE FLOWSHOPS (SYSTEMS ASPECTS OF FLEXIBLE MANUFACTURING SYSTEMS)

K. L. Hitz Mar. 1979 78 p refs

(Grants NSF DAR-78-17826; NSF APR-76-12036)

(PB-301218/4; LIDS-R-879; NSF/RA-790103) Avail: NTIS HC A05/MF A01 CSCL 05A

The scheduling of production in a deterministic Flexible Flow Shop is discussed. This is a serial arrangement of buffered multipurpose machines connected by a conveyor system which allows fully mechanized parts handling. Machines can be bypassed, and simultaneous processing of parts with different machine routes is possible. The problem of producing a range of part types of specified ratios, with known fixed transport and processing times is considered. Optimal schedules are characterized as periodic loading sequences which minimize idle time on bottleneck machines once they have begun operating, while satisfying constraints on buffer capacity. The computation of optimal schedules by an implicit enumeration algorithm is discussed. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-15980* National Aeronautics and Space Administration, Washington, D. C.

NASA PUBLICATIONS

Sep 1978 15 p

(NASA-TM-80852) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 05B

A list of NASA educational publications is presented along with abstracts. Prices and ordering instructions are included. K.L.

N80-15981# Library of Congress, Washington, D. C. Network Development Office.

STUDY OF MESSAGE TEXT FORMATS: BIBLIOGRAPHIC SEARCH QUERIES

Philip L. Long and David C. Hartmann, ed. 1979 31 p

(ISSN-0160-9742) Avail: NTIS HC A03/MF A01

Efforts toward the development of a national network of libraries and information services are reviewed. Seven existing bibliographic systems were surveyed in order to collect applications message queries and response formats for appropriate catagorization and classification. In order to compare search arguments used on various systems, a metalanguage was developed to described the format and syntax of the search arguments. Topics discussed include search argument metalanguage and formats; status/error message format; and search query responses. A.R.H.

N80-15982# Planning Research Corp., McLean, Va.

INVERTED FILE FACILITY: USER'S GUIDE Final Report

S. Tamberrino 31 Aug. 1977 97 p

(Contract DCA100-73-C-0015)

(AD-A074081; PRC-706-22) Avail: NTIS HC A05/MF A01 CSCL 05/2

The Inverted File Facility (INVFF) is an extension of the Indexed Sequential Processor (ISP) which allows the user to build, retrieve from, and update inverted data bases. In addition to the ISP's data file and index file, the INVFF uses an inverted index file which provides the following additional file processing capabilities: (1) the ability to distinguish each data record as being a specific type and (2) the ability to process data records randomly through the specification of values contained within a record. GRA

N80-15983# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.

AERODYNAMIC DATA BASE USERS GUIDE

George M. Landingham 5 Jun. 1979 27 p

(AD-A074448; DRDMI-T-79-62) Avail: NTIS HC A03/MF A01 CSCL 05/2

A data base system has been developed for storage and interactive analysis of data. This report is intended as a description of the system and as a user's guide. The equipment on which the data base system is implemented is detailed. A description of the data base structure and detailed instructions for using the system are included. GRA

N80-15984# Operations Research, Inc., Silver Spring, Md.

DEVELOPMENT OF A QUALITY ASSURANCE METHODOLOGY FOR THE TECHNICAL INFORMATION GENERATION SUBSYSTEM OF NTIPS Final Report, Apr. - Dec. 1978

Don D. Deardorff, Kenneth C. Hageman, Wilburn Hehs, and James M. Norton Mar. 1979 102 p refs Prepared in cooperation with Hageman, Inc., Fort Worth, Tex.

(Contract N00019-78-C-0175)

(AD-A074299) Avail: NTIS HC A06/MF A01 CSCL 05/1

Volume I of this report provides: (1) a brief description of current Technical Publications development and Quality Assurance programs, (2) a description of NTIPS (Navy Technical Information Presentation System), (3) a detailed discussion of the content generation phase of NTIPS, and (4) a detailed discussion of a Quality Assurance program designed for contractor implementation during the contract generation phase. Volume II of the report is a draft Quality Assurance Specification for Technical Publications and supporting Data Item Descriptions (DID's). GRA

N80-15985# Stanford Univ., Calif. Dept. of Computer Science.

A STRUCTURAL MODEL FOR DATABASE SYSTEMS

Gio Weiderhold and Ramez El-Masri Feb. 1979 59 p refs

(Contract MDA903-77-C-0322)

(AD-A074077; SU-STAN-CS-79-722) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report presents a model to be used for database design. Because our motivation extends to providing guidance for the structured implementation of a database, we call our model the Structural Model. We derive the design using criteria of correctness, relevance, and performance from semantic and operational specifications obtained from multiple sources. These sources typically correspond to prospective users or user groups of the database. The integration of such specifications is a central issue in the development of an integrated structural database model. The structural model is used for the design of the logical structures that represent a real-world situation. However, it is not meant to represent all possible real-world semantics, but a subset of the semantics which are important in database modeling. GRA

N80-15986# Ford Aerospace and Communications Corp., Palo Alto, Calif.

***PRELIMINARY DESIGN OF A NETWORK VIRTUAL DATA BASE SYSTEM* Final Report**

Griffiss AFB, N.Y. RADC Aug. 1979 151 p refs

(Contract F30602-77-C-0158; AF Proj. 0173)

(AD-A074205; RADC-TR-79-102) Avail: NTIS HC A08/MF A01 CSCL 09/2

Development of the Network Virtual Data Base System (NVDBS) and the Adaptive User Interface (AUI) address several needs of DOD intelligence systems. The NVDBS could provide a bridge between different data base management systems (DMBSs) on different host computers (nodes) linked through a network, without being required to know how to access each DBMS directly. The network level description of the information and its logical structures would be interactively available to the

casual user. The informed user could then 'navigate' through the Network Data Model (NDM). Further, the analyst could discover and link correlated data, for the NVDBS will support 'virtual linkages' between records physically located on different DBMSs of the NVDBS network. For a DBMS to be accessible on the NVDBS network, it must be on a node of the network, and must be linked to the NVDBS through an interface tailored to the idiosyncrasies of the particular DBMS and node. The NVDBS will behave as an ordinary user of each DBMS on the network. The NVDBS also will support the creation of 'virtual linkages' between record instances physically located on different hosts. This report overviews the preliminary design study. GRA

N80-15987# Stanford Univ., Calif. Dept. of Computer Science.
INDUCTION OVER LARGE DATA BASES
J. R. Quinlan May 1979 21 p refs
(Contract MDA903-77-C-0322)
(AD-A074075; SU-STAN-CS-79-739; HPP-79-14) Avail: NTIS HC A02/MF A01 CSCL 09/2

Techniques for discovering rules by induction from large collections of instances are developed. These are based on an iterative scheme for dividing the instances into two sets, only one of which needs to be randomly accessible. These techniques have made it possible to discover complex rules from data bases containing many thousand of instances. Results of several experiments using them are reported. GRA

N80-15988# Los Alamos Scientific Lab., N. Mex. Computer Science and Services Div.
COMMON FILE SYSTEM REFERENCE MANUAL, PIM-5
Jun. 1979 115 p
(Contract W-7405-eng-36)
(LA-5525-M-Vol-5) Avail: NTIS HC A06/MF A01

A brief overview of the features of the common file system is presented. Specific information about how to use the system is included. The structure of the file organization and a utility called MASS, which is used to access the common file system are described. DOE

N80-15989# QEI, Inc., Bedford, Mass.
INFORMATION MANAGEMENT PROBLEMS RELATING TO NUMERIC DATA BASE SERVICES FOR DOE. Interim Report for Phase 2 of QEI Proj. 4191
J. W. Kuipers and R. W. Thorpe 13 Apr. 1979 51 p refs
(Contract EV-78-C-01-6182)
(DOE/TIC-10144; QEI-Report-9413) Avail: NTIS HC A03/MF A01

Problems of numeric data are examined as these relate to the question of possible steps toward implementation of an integrated national information system. It is proposed that policy and organization changes be made in order to centralize and upgrade information management. Eight points to be emphasized in such a program are set forth. DOE

N80-15990# National Technical Information Service, Springfield, Va.
ON-LINE INFORMATION RETRIEVAL SYSTEMS. VOLUME 2: A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Sep. 1979
Mary E. Young Sep. 1979 124 p Supersedes NTIS/PS-78/0979; NTIS/PS-77/0817; NTIS/PS-76/0755; NTIS/PS-75/513
(NTIS/PS-79/0971/6; NTIS/PS-78/0979; NTIS/PS-77/0817; NTIS/PS-76/0755; NTIS/PS-75/513) Avail: NTIS HC $28.00/MF $28.00 CSCL 05B

On-line computer systems for retrieval of information are described in the 118 reports cited. Systems development, formats of large and small systems, instructions for use and comparisons of operating networks are included. This updated bibliography contains 118 abstracts, 45 of which are new entries to the previous edition. GRA

N80-15991# North Carolina Univ. at Chapel Hill.
NTIS: CONCEPT OF THE CLEARINGHOUSE, 1945 - 1979 M.S. Thesis
Mary Glen Chitty Mar. 1979 74 p refs
(PB-300947/9) Avail: NTIS HC A04/MF A01 CSCL 05B

The functions of Federal Technical Information Agencies in serving as a central source for dissemination of the results of federally funded scientific and technical research reports, are examined. Changes in emphasis and scope are contrasted with consistency of adherence to the original directives. Discrepancies between stated objectives and actual areas of concentration are noted. Administrative policies and constraints are considered in relation to their impact on the agency and its users. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-15992# Commerce Dept., Washington, D.C. Industry and Trade Administration.
PETROCHEMICALS: THEIR ECONOMIC SIGNIFICANCE IN THE DOMESTIC ECONOMY
Harry Pfann Jul. 1979 91 p refs
(PB-299733/6) Avail: NTIS HC A05/MF A01 CSCL 05C

The economic significance of petrochemicals within the domestic economy is considered along with their importance in U.S. export trade and their requirements for energy and feedstocks. The importance of fuels and of feedstocks to the industry is noted and data are presented on the quantity of hydrocarbons which are used by the industry for both feedstocks and as energy. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-15993# Department of Energy, Washington, D. C. Office of Analytical Services.
REPORT TO CONGRESS ON THE ECONOMIC IMPACT OF ENERGY ACTIONS AS REQUIRED BY PUBLIC LAW 93-275, SECTION 18-D
Sep. 1978 198 p
(DOE/PE-0007) Avail: NTIS HC A09/MF A01

Economic impact analyses are summarized for: (1) two regulatory changes pertaining to crude oil production in California; (2) a change in price regulations for resale of crude oil; and (3) energy efficiency targets for 13 appliances. A recommendation is presented for Federal Programs of employment or economic assistance to minimize the effect of energy shortages or energy actions. K.L.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-15994# Committee on Science and Technology (U. S. House).
TOWARD THE ENDLESS FRONTIER: HISTORY OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY 1959 - 1979
Ken Hechler 1980 1107 p refs
(GPO-35-120) Avail: SOD HC

The history of the Committee on Science and Technology is reviewed from its beginning in 1959 through the year 1979. Topics include space missions, space science, international scientific cooperation, energy technology, aeronautics and

transportation, and natural resources and the environment.
A.W.H.

NBD-15995/ California Univ., Livermore. Lawrence Livermore Lab.
ENERGY STORAGE SYSTEM FOR AUTOMOBILE PROPULSION, 1978 STUDY. 2: DETAILED REPORT
E. Behrin, C. J. Anderson, H. Bomelburg, M. Farahat, H. C. Forsberg, C. L. Hudson, B. C. Kullman, L. G. OConnell, G. Strickland, and W. J. Walsh 15 Dec. 1978 294 p refs
(Contract W-7405-eng-48)
(UCRL-52553-Vol-2) Avail: NTIS HC A13/MF A01

The results for FY 1978 of a national, multilaboratory study of energy storage propulsion systems for automobiles are presented including an evaluation of how changing the relationship between specific peak power and specific energy affects electric vehicle performance. Also included are an update of previous results based on new information obtained from ongoing research and development programs, as well as the results of a national energy impact and market penetration analysis of representative future energy storage vehicles. DOE

NBD-15996/ Sandia Labs., Albuquerque, N. Mex.
PATHOGEN REDUCTION IN SLUDGES BY IRRADIATION
J. R. Brandon 1978 18 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1957C) Avail: NTIS HC A02/MF A01

The use of ionizing radiation to disinfect municipal waste water and sludge is discussed. Pathogenic bacteria, parasites, and viruses are reviewed and studies concerning their investigation by ionizing radiation are summarized. K.L.

NBD-15997/ Argonne National Lab., Ill.
SCRAP: THEORY AND MODELING CONSIDERATIONS
T. J. Moran Jul. 1979 28 p refs
(Contract W-31-109-eng-38)
(ANL-CT-79-49) Avail: NTIS HC A03/MF A01

The theoretical basis for the FORTRAN IV computer code SCRAP is presented. Guidance for modeling fast reactor core structures with the code is included. DOE

NBD-15998/ Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
EFFECT OF INFRARED RADIATION ON COMPACTION OF MUNICIPLE WASTEWATER SLUDGES Final Report
R. S. Ingols, S. C. Havlicek, M. H. Poythress, and J. D. Lupton 1979 56 p
(Grant NSF ENV-77-15086)
(PB-298296/5; NSF/RA-790047) Avail: NTIS HC A04/MF A01 CSCL 13B

An unusually strong infrared-induced compaction of poorly settling sludges observed at Macon's Rocky Creek wastewater treatment facility was studied. It was discovered that the phenomenon has two components-that which is induced by heat alone and that which is induced by the irradiation alone. Furthermore, the phenomenon was generally observed in poorly settling sludges during the early stages of bulking. Other finds were: (1) IR wavelengths of 2200-2300/cm seemed to be the most effective; (2) irradiated sludge, when resuspended, settled better than untreated sludge; (3) added polyelectrolytes vastly improved settling regardless of irradiation; and (4) lignosulfonate, a major constituent of pulpmill wastes, had little effect on the phenomenon. GRA

NBD-15999/ Transportation Research Board, Washington, D.C.
URBAN TRANSPORTATION PLANNING, EVALUATION, AND ANALYSIS
James M. Witkowski, William C. Taylor, Edward Beimborn, David F. Schulz, and Kenneth R. Yunker 1979 59 p refs
(PB-300749/9; TRB/TRR-707; ISBN-0-309-02953-8; LC-79-607099) Avail: NTIS HC A04/MF A01; Paper copy also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C., 20418, HC $3.40 CSCL 13B

The topics discussed include: (1) urban transportation planning under energy constraints; (2) long-range transportation planning in southeastern Wisconsin; (3) preliminary screening of transit corridor alternatives; (4) highway location selection; (5) macroanalysis for transit integration; (6) discrete optimization in transportation networks; (7) residential area location preference surfaces; and (8) ethics of politically oriented transportation planning.GRA

NBD-16000/ Transportation Research Board, Washington, D.C.
NEW TRANSPORTATION SYSTEMS AND TECHNOLOGY, 1979: TRANSPORTATION RESEARCH RECORD 708
Jeffrey M. Zupan, Donald E. Ward, Granville E. Paules, Steven E. Shladover, and Waheed Siddiqee 1979 34 p refs
(PB-300747/3; TRB/TRR-708; ISBN-0-309-02954-6; LC-79-607112) Avail: NTIS HC A03/MF A01; Hard copy also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C., 20418, HC $3.00 CSCL 13B

Contents: patronage estimate for downtown people movers; development of efficient central management strategies for advanced group rapid transit systems; electric cars for urban transportation; and assessment of market potentials for electric vehicles. GRA

NBD-16001/ Municipal Environmental Research Lab., Cincinnati, Ohio. Wastewater Research Div.
PROGRESS IN WASTEWATER DISINFECTION TECHNOLOGY Final Report
Albert D. Venosa, (ed.) Jun. 1979 298 p refs Presented at National Symp., Cincinnati, 18-20 Sep. 1978
(PB-299338/4; EPA-600/9-79-018) Avail: NTIS HC A13/MF A01 CSCL 13B

Contents: (1) chlorination; (2) chlorine dioxide- analytical measurement and pilot plant evaluation; (3) ultraviolet light; (4) ozone; (5) viruses and organics; and (6) planning and implementation. GRA

NBD-16002/ California Univ., Los Angeles. Environmental Science and Engineering.
INSTITUTIONAL BARRIERS TO WASTEWATER REUSE
Laura M. Lake and Richard L. Perrine 1979 340 p refs
(Contract Di-14-34-0001-7814)
(PB-299027/3; W79-09050; OWRT-R-0064-7814-2) Avail: NTIS HC A15/MF A01 CSCL 13B

Institutional barriers to enhanced reuse of wastewater as a supplement or replacement for added freshwater supply are assessed. Four areas of critical institutional concern are analyzed: (1) issues related to the administrative and institutional framework within which operations must be managed; (2) the legal framework which applies to reuse; (3) the economics, financing and pricing of reclaimed wastewater; and (4) issues growing from the risk to public health of reuse of treated wastewater. Conclusions on issues of major importance are presented and recommendations are given in the report. GRA

NBD-16003/ General Accounting Office, Washington, D. C. Community and Economic Development Div.
IMPROVING THE SCIENTIFIC AND TECHNICAL INFORMATION AVAILABLE TO THE ENVIRONMENTAL PROTECTION AGENCY IN ITS DECISION MAKING PROCESS Report to the Congress
21 Sep. 1979 71 p
(PB-300580/8; CED-79-115) Avail: NTIS HC A04/MF A01 CSCL 05A

Formal procedures for the assessment of scientific and technical information in governmental decision making are suggested: formal participation of science organizations, the establishment of issue oriented commissions, and a 'science court' for ventilating scientific disputes during the decision making process are discussed and contrasted. M.G.

NBD-16004/ National Bureau of Standards, Washington, D.C. National Engineering Lab.
INTERNATIONAL ACTIVITIES: THE FISCAL YEAR 1978 SURVEY OF INTERNATIONAL PROGRAMS AT NEL
Samuel Kramer and Michael Olmert Aug. 1979 122 p
(PB-300491/8; NBSIR-79-1792) Avail: NTIS HC A06/MF A01 CSCL 05A

An international survey of engineering research activities is presented. Production engineering, communications, electron devices, fiber optics, ergonomics, housing and construction, fire safety engineering, materials engineering, cryogenics, alternative

energy sources, electron microscopy, and superconductors are included. M.G.

N80-16005# American Association for the Advancement of Science, Washington, D.C. Office of Opportunities in Science.
A RESEARCH AGENDA ON SCIENCE AND TECHNOLOGY FOR THE HANDICAPPED
Janet Welsh Brown and Martha Ross Redden Jan. 1979 58 p refs
(Contract NSF OPA-78-25354)
(PB-301220/0; NSF/RA-790063) Avail: NTIS HC A04/MF A01 CSCL 05K

A research agenda was developed in science and technology for the handicapped designed to provide support for planning a new research program. High and low technology, adults and children, basic and applied research, and hardware developments and social science research are discussed. Recommendations are categorized first by major disability groups and then listed by those recommendations that cut across disabilities, especially those with policy, educational and training implications. Included are: mobility impairment; neuromuscular/skeletal disabilities; visual disability; hearing impairment; vocal impairment; psychological and social issues for research; economic issues for research; and principles for operating a program of search and development for the physically handicapped. GRA

N80-16006# Gumham and Associates, Inc., Chicago, Ill.
PERFORMANCE EVALUATION OF THE EXISTING THREE LAGOON WASTEWATER TREATMENT PLANT AT PAWNEE, ILLINOIS Final Report, 1975 - 1977
C. Fred Gurham, B. A. Rose, and W. T. Fetherston Jul. 1979 151 p
(Grant EPA-R-803900)
(PB-299740/1; EPA-600/2-79-043) Avail: NTIS HC A08/MF A01 CSCL 13B

Data gathered over a one-year period of monitoring the lagoon system at Pawnee, Illinois are presented and treatment plant performance is compared to design loading rates and the Federal secondary treatment standards. Removal of BOD5 and fecal coliforms was found to be excellent. The lagoons performed satisfactorily during the winter months, and anaerobic conditions did not develop despite a thick ice layer. GRA

N80-16007# Polytechnic Inst. of New York. Transportation Training and Research Center.
A METHODOLOGY FOR EVALUATING THE EFFECTIVENESS OF TRANSPORTATION IMPROVEMENTS FOR THE ELDERLY AND HANDICAPPED Final Report, Sep. 1977 - Nov. 1978
John Falcocchio Washington, D.C. DOT Jun. 1979 112 p
(Contract DOT-OS-70084)
(PB-300440/5; TR-78/503; DOT-RSPA-DPB-50-79-2) Avail: NTIS HC A06/MF A01 CSCL 13B

Transportation services were evaluated from the viewpoint of the elderly and handicapped users. A cost-effectiveness methodology for evaluating existing services and transportation improvements, and service design standards for different types of handicap severity were developed. The transportation services considered are the city transit system (bus and subway); taxi service; EASYRIDE service; and the ambulette service. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-16008*# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
LYMAN ALPHA INITIATED WINDS IN LATE-TYPE STARS
B. M. Haisch, J. L. Linsky, and K. A. vanderHucht [1979] 11 p refs
(Contract NAS5-23274; Grant NGL-06-003-057)
(NASA-CR-162467) Avail: NTIS HC A02/MF A01 CSCL 03A

The IUE survey of late-type stars revealed a sharp division in the HR diagram between stars with solar type spectra (chromosphere and transition region lines) and those with non-solar type spectra (only chromosphere lines). Models of both hot coronae and cool wind flows were calculated using stellar model chromospheres as starting points for stellar wind calculations in order to investigate the possibility of having a supersonic transition locus in the HR diagram dividing hot coronae from cool winds. From these models, it is concluded that the Lyman alpha flux may play an important role in determining the location of a stellar wind critical point. The interaction of Lyman alpha radiation pressure with Alfven waves in producing strong, low temperature stellar winds in the star Arcturus is examined. A.R.H.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

No abstracts in this category.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-16009*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
HANDBOOK OF LUNAR MATERIALS
Richard J. Williams, ed. and James J. Jadwick, ed. (Lockheed Electronics Co., Houston, Tex.) Feb. 1980 133 p refs
(NASA-RP-1057) Avail: NTIS HC A07/MF A01 CSCL 03B

The physical, chemical, thermodynamic, and geologic data on lunar rocks, minerals, and processes are summarized, and a set of data metals that might be extracted from lunar materials is presented. Author

N80-16010*# National Aeronautics and Space Administration, Washington, D. C. Planetary Div.
REPORTS OF PLANETARY GEOLOGY PROGRAM, 1979 - 1980
P. Wirth, (comp.), R. Greeley, (comp.), and R. D'Alli, (comp.) Jan. 1980 409 p refs
(NASA-TM-81776) Avail: NTIS HC A18/MF A01 CSCL 03B

Abstracts of 145 reports are compiled addressing the morphology, geochemistry, and stratigraphy of planetary surfaces with some specific examinations of volcanic, aeolian, fluvial, and periglacial processes and landforms. In addition, reports on cartography and remote sensing of planet surfaces are included. M.G.

N80-16011*# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
THE CHEMISTRY OF VENUS' ATMOSPHERE Annual Project, Jul. 1977 - Jul. 1978
Nien Dak Sze and William H. Smith Jul. 1978 63 p refs
(Contract NAS5-24164)

(NASA-CR-159951) Avail: NTIS HC A04/MF A01 CSCL 03B

A model for the Venus atmosphere involving photochemistry of oxygen, hydrogen, chlorine and sulfur species is presented. Sulfur reaction schemes and hydrogen and chlorine reaction schemes were included. The impact of sulfur on the oxygen budget and the subsequent production of H2SO4 molecules for the Venus cloud deck were explored. A major new reaction scheme for production of H2SO4 molecules involving sulfur and oxygen chemistry was established shown to dominate over the odd hydrogen scheme proposed earlier. The efficiency of the scheme in formation of H2SO4 is only about 50%, with the remaining sulfur residing in SO2 molecules. The calculated downward flux of H2SO4 may be sufficient to maintain a steady state sulfuric acid cloud if the resident time of H2SO4 droplets in the cloud is as long as a few years. If however, the resident time is half a year or shorter, additional chemistry capable of more efficient conversion of SO2 to SO3 is required. A.R.H.

N80-16012*# Alaska Univ., Fairbanks. Geophysical Inst.

AIRBORNE MEASUREMENTS OF SOLAR AND PLANETARY NEAR ULTRAVIOLET RADIATION DURING THE NASA/ESA CV-900 SPACELAB SIMULATION Final Report

G. G. Sivjee Apr. 1977 33 p refs
(Grant NsG-2053)
(NASA-CR-162566) Avail: NTIS HC A03/MF A01 CSCL 03B

Results from a comparative study of the feasibility of employing experiment operators on the space shuttle to acquire scientifically worthwhile data are presented. The experiments performed during these tests included spectral observations of the Sun and Venus in the near ultraviolet region. The solar measurements were analyzed to determine ozone abundance in the terrestrial atmosphere. Using a detailed spectral matching technique to compare airborne solar UV measurements with synthetic spectric profiles of sunlight, it is deduced that in winter the total atmospheric ozone abundance is about 0.33 atm/cm at midlatitudes in the northern hemisphere. M.G.

N80-16013*# Massachusetts Inst. of Tech., Cambridge.

CRYSTALLIZATION, FLOW AND THERMAL HISTORIES OF LUNAR AND TERRESTRIAL COMPOSITIONS Final Report

D. R. Uhlmann 1979 75 p refs
(Grant NGR-22-009-646)
(NASA-CR-162445) Avail: NTIS HC A04/MF A01 CSCL 03B

Contents: a kinetic treatment of glass formation; effects of nucleating heterogeneities on glass formation; glass formation under continuous cooling conditions; crystallization statistics; kinetics of crystal nucleation; diffusion controlled crystal growth; crystallization of lunar compositions; crystallization between solidus and liquidus; crystallization on reheating a glass; temperature distributions during crystallization; crystallization of anorthite and anorthite-albite compositions; effect of oxidation state on viscosity; diffusive creep and viscous flow; high temperature flow behavior of glass-forming liquids, a free volume interpretation; viscous flow behavior of lunar compositions; thermal history of orange soil material; breccias formation by viscous sintering; viscous sintering; thermal histories of breccias; solute partitioning and thermal history of lunar rocks; heat flow in impact melts; and thermal histories of olivines. A.R.H.

N80-16014*# Texas A&M Univ., College Station. Dept. of Geophysics.

VELOCITY MODEL OF THE SHALLOW LUNAR CRUST Final Report

Anthony F. Gangi 1 Jan. 1980 159 p refs
(Grant NsG-7417)
(NASA-CR-162573) Avail: NTIS HC A08/MF A01 CSCL 03B

The travel times of the seismic waves obtained for the Apollo-14 and -16 active seismic experiments and the Apollo-16 grenade launches are shown to be consistent with a powder-layer model of the shallow lunar crust. The velocity variation with depth determined from these data is: V(z) = approximately 110 z to the 1/6 power m/sec for z less than 10 meters and V(z) is nearly = to 250 m/sec for z greater than 10 meters. The velocity values found for the 10 meter depth are similar to those found by Kovach, et al. (1972). The z to the 1/6 power depth dependence for the velocity of the topmost layer is that predicted on the basis of a powder layer (Gangi, 1972). The Amplitude variation of the direct waves as a function of source-to-receiver separation, x, is A(x) = A(o)x to the -n power exp(-ax) where 1.5 < n < 2.2 and a is nearly = to 0.047 neper/m. Velocity-spectra analyses of the direct, surface-reflected, bottom-reflected and refracted waves give results that are consistent with the velocity model inferred from the traveltime data. Author

N80-16015*# Hawaii Univ., Honolulu. Inst. of Geophysics.

GEOCHEMISTRY OF LUNAR AND PLANETARY PROCESSES Final Technical Report, 15 Jul. 1978 - 30 Sep. 1979

John A. Philpotts Sep. 1979 22 p refs
(Grant NsG-9071)
(NASA-CR-162583) Avail: NTIS HC A02/MF A01 CSCL 03B

Progress is reported in the following areas: (1) consideration of silica in excess of stoichiometry in lunar feldspars; (2) calculation of equilibration temperatures for meteorites and lunar samples; (3) investigation of the effect of rapid crystallization in lunar mare basalts on element partitioning; and (4) development of a technique for suppressing oxide interference during mass spectrometric analysis for rare earth elements. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-16016*# Lockheed Missiles and Space Co., Palo Alto, Calif.

ANALYSIS OF X-RAY AND EUV SPECTRA OF SOLAR ACTIVE REGIONS Final Report

Keith T. Strong and Loren W. Acton 1979 205 p
(Contract NAS8-33195)
(NASA-CR-161364) Avail: NTIS HC A10/MF A01 CSCL 03B

Data acquired by two flights of an array of six Bragg crystal spectrometers on an Aerobee rocket to obtain high spatial and spectral resolution observations of various coronal features at soft X-ray wavelengths (9-23A) were analyzed. The various aspects of the analysis of the X-ray data are described. These observations were coordinated with observations from the experiments on the Apollo Telescope Mount and the various data sets were related to one another. The Appendices contain the published results, abstracts of papers, computer code descriptions and preprints of papers, all produced as a result of this research project. A.R.H.

N80-16017*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

THE SUDDEN COMMENCEMENT SOLAR PROTON FLUX ENHANCEMENT OF 31 OCTOBER 1972 Interim Report

J. Bernard Blake and George A. Paulikas 31 Aug. 1979 29 p refs
(Contract F04701-78-C-0079)
(AD-A074546; TR-0079-4960-05-5; SAMSO-TR-79-94) Avail: NTIS HC A03/MF A01 CSCL 04/1

The sudden commencement (sc) solar proton enhancement of 31 October 1972 is examined in detail. The flux of 5-21 MeV protons observed by ATS-1 increased by a factor of 25 as a result of the sudden commencement. Drift echoes (indicating trapped particles) were seen clearly following the sc with a period of the order of 70 seconds as expected for protons with energies just above 5 MeV. Decay times ranging from 17 to 56 minutes were seen during the decay. The decay time changed as the magnetosphere reacted to varying solar wind conditions which were indicated by ground-based magnetometer records. It is also shown that plasma intrusions into the outer magnetosphere from the solar wind, as discussed by Lemaire and colleagues, can serve as strong scattering centers, providing access for and greatly reducing the otherwise expected trapping lifetimes of sc-enhanced solar protons. GRA

N80-16018# Naval Research Lab., Washington, D. C.
SOLAR FLARE SPECTROSCOPIC DIAGNOSTICS FOR WAVELENGTHS LESS THAN 2000 ANGSTROMS Interim Report
G. A. Doschek and U. Feldman 27 Jun. 1979 33 p refs
(AD-A070569; NRL-8307) Avail: NTIS HC A03/MF A01 CSCL 03/2

We discuss the use of intensity ratios of emission lines for determining the electron density and temperature in flare plasmas. The availability diagnostics cover the temperature range from about 40,000 K to about 10,000,000 K. We summarize the current work on flare density diagnostics and review the applications of this theory to available flare spectra. We discuss the importance of line profiles for determining nonthermal mass motions in the plasma and for estimating path lengths along the line of sight. We review the current information on line profiles in flare spectra. We comment on determining departures from ionization equilibrium using line ratios in the X-ray and EUV regions. GRA

N80-16019# Los Alamos Scientific Lab., N. Mex.
IMAGING X-RAY SPECTROMETER TO STUDY SOLAR ACTIVITY IN CONJUNCTION WITH THE SCADM PROGRAM
R. L. Blake 1979 16 p refs Presented at Solar Cycle and Dyn. Mission Conf., Wellesley, Mass., 14 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1921; CONF-7906111) Avail: NTIS HC A02/MF A01

An experiment to study solar active region dynamics and evolution is reported. A spectrometer imaging X-rays (SIX) is discussed in relation to the capacity of simultaneous high resolution imaging, spectral dispersion, and time resolution for observing the processes involved in the buildup and release of energy in the solar corona. A tabular summary of the main SIX experiment characteristics is presented. A.W.H.

N80-16020# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 414, SUPPLEMENT, FEBRUARY 1979. PART 2: COMPREHENSIVE REPORTS. DTA FOR DECEMBER 1978, NOVEMBER 1978 AND MISCELLANEA
Helen E. Coffey, ed. Jun. 1979 81 p
(PB-299340/0; SGD-418-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 03B

The data for December 1978 on: active regions, synoptic solar maps, solar radio emission, energetic solar particles and plasma, and solar x ray radiation are presented. Synoptic charts and an abbreviated calendar record for November 1978 are provided. GRA

N80-16021# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR GEOPHYSICAL DATA NUMBER 418, JUNE 1979. PART 1: PROMPT REPORTS. DATA FOR MAY 1979, APRIL 1979. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 414 (SUPPLEMENT) FEBRUARY 1979
Helen E. Coffey, ed. Jun. 1979 168 p
(PB-299694/0; SGD-418-Pt-1; NOAA-79072310) Avail: NTIS HC A08/MF A01 CSCL 03B

The data for May 1979 on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, coronal holes, solar wind measurements, infrared interplanetary magnetic field polarities, and mean solar magnetic field are presented. The data for April 1979 on: daily solar activity center, sudden ionospheric disturbances, solar x-ray radiation, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices are included. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

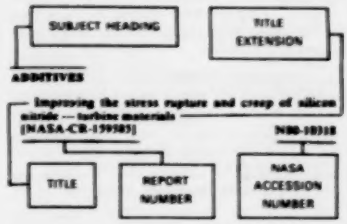
99 GENERAL

N80-16022# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT Quarterly Report, 1 Apr. - 30 Jun. 1979
30 Jun. 1979 103 p
(AD-A074885; DME/NAE-1979-2) Avail: NTIS HC A06/MF A01 CSCL 01/3

Progress in research applicable to aeronautics is summarized. Specific attention is given to the development of a minicomputer based controller designed for gas pipeline station control. The role of computer models and simulation techniques is emphasized. A railway switch car designed to operate in snow and ice is also described. Design modifications recommended to improve the mechanical performance and endurance of the switch are included. J.M.S.

SUBJECT INDEX

Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

A

A-10 AIRCRAFT
Evaluation of the aerodynamic characteristics of a 1/20-scale A-10 model at Mach numbers from 0.30 to 0.75
[AD-A074867] N80-15055

ABLATION
Plasma-sprayed dual density ceramic turbine seal system
[NASA-CR-159739] N80-15411

ABSORPTION CROSS SECTIONS
Quantitative comparison of multiple-photon absorption in polyatomic molecules
[CONF-790690-3] N80-15892

ACCELERATED LIFE TESTS
Evaluation of 100 mm bore bearings after accelerated testing in a simulated space environment
[AD-A074527] N80-15413

ACCELERATION [PHYSICS]
The effects of motion and g-seat cues on pilot simulator performance of three piloting tasks
[NASA-TP-1601] N80-15069

ACCELERATION STRESSES [PHYSIOLOGY]
Physical forces generating acceleration, vibration, and impact — physiological effects
N80-15792

ACCELERATION TOLERANCE
Physical forces generating acceleration, vibration, and impact — physiological effects
N80-15792

ACCURACY
Accuracy assessment: The statistical approach to performance evaluation in LACIE — Great Plains corridor, United States
N80-15459

Accuracy assessment system and operation
N80-15472

Accuracy and performance of LACIE area estimates — wheat yield in the U.S. Great Plains States
N80-15487

Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world
N80-15488

Accuracy and performance of LACIE crop development models
N80-15489

ACID RAIN
Acid rain: Mesoscale model
N80-15655

Acid rain: Microphysical model
N80-15656

Air quality monitor and acid rain networks
N80-15659

ACOUSTIC ATTENUATION
Evaluation of approximate methods for the prediction of noise shielding by airframe components
[NASA-TP-1904] N80-15129

Refractory metals for ultrasonic thermometry applications
[NUREG-CR-0368] N80-15253

Comparison of inlet suppressor data with approximate theory based on cutoff ratio
[NASA-TM-81386] N80-15876

ACOUSTIC EMISSION
On the output of acoustical sources
[NASA-CR-162576] N80-15872

ACOUSTIC EXCITATION
Response of nonlinear structural panels subjected to high intensity noise
[AD-A074986] N80-15432

ACOUSTIC INSTABILITY
Characterization of acoustic disturbances in linearly sheared flows
[NASA-CR-162577] N80-15869

ACOUSTIC MEASUREMENTS
An experimental study of the structure and acoustic field of a jet in a cross stream — Ames 7-ft by 10-ft wind tunnel tests
[NASA-CR-162464] N80-15871

ACOUSTIC RETROFITTING
Quiet Clean Short-Haul Experimental Engine [QCSEE]: Acoustic treatment development and design
[NASA-CR-135266] N80-15122

ACOUSTIC SCATTERING
Acoustic resonances and sound scattering by a shear layer
[NASA-CR-162575] N80-15873

ACOUSTIC SOUNDING
Atmospheric echo sounding. A bibliography with abstracts
[NTIS/PS-79/0989/8] N80-15721

ACOUSTIC VELOCITY
Refractory metals for ultrasonic thermometry applications
[NUREG-CR-0368] N80-15253

ACOUSTICS
Quiet Clean Short-haul Experimental Engine [QCSEE] Over-The-Wing [OTW] propulsion systems test report, Volume 4: Acoustic performance
[NASA-CR-135326] N80-15118

ACOUSTO-OPTICS
Pulsed dye laser OAS with a Helmholtz resonator cell
[CONF-790819] N80-15404

Acoustically scanned optical imaging devices
[AD-A074954] N80-15915

Acoustic microscopy at cryogenic temperatures
[AD-A074502] N80-15919

ACRYLIC RESINS
Development of a special purpose spacecraft interior coating, phase 2
[NASA-CR-160441] N80-15199

ACTIVATED CARBON
An evaluation of activated carbon for drinking water treatment
[PB-299968/8] N80-15228

ACTUATORS
Quiet Clean Short-haul Experimental Engine [QCSEE]. Ball spline pitch change mechanism design report
[NASA-CR-134873] N80-15101

Quiet Clean Short-haul Experimental Engine [QCSEE] whirl test of cam/harmonic pitch change actuation system
[NASA-CR-135140] N80-15117

Development of a high-voltage linear actuator amplifier system
[AD-A074266] N80-15343

ADAPTATION
Rat reaction to hypokinesia after prior adaptation to hypoxia
[NASA-TM-75964] N80-15782

ADAPTIVE CONTROL
Power optimization in adaptive array: A technique for interference protection
[AD-A074429] N80-15311

On-board multispectral classification study. Volume 2: Supplementary tasks — adaptive control
[NASA-CR-159178] N80-15539

Investigation of adaptive control for recoil mechanisms
[AD-A074024] N80-15851

ADDITIVES
Radiation damage in lithium-counterdoped n/p silicon solar cells
[NASA-TM-81391] N80-15557

ADHESION
Adhesion and friction of iron-base binary alloys in contact with silicon carbide in vacuum
[NASA-TP-1604] N80-15234

ADHESIVE BONDING
Treatment of Am 355 steel for adhesive bonding
[AD-A074113] N80-15236

ADVECTION
FLUFLOW: An appended code for calculating heat transfer to a fluid
[SAND-78-8275] N80-15377

Moisture advection and the Sangster chart
[AD-A073432] N80-15744

AERATION
Estimating the gas and dye quantities for modified tracer technique measurement of stream reaeration coefficients
[PB-299015/8] N80-15690

AERIAL PHOTOGRAPHY
Concept development of automated image analysis. Automated contour recognition and classification in aerial photography by means of angles and curvature
[AD-A074439] N80-15540

US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 9: Conservation of natural areas and of the genetic material they contain
[PB-297931/8] N80-15547

AERIAL BUDDERS
Fin design with ACT in the presence of strakes
N80-15161

AEROBIOLOGY
Airborne aeroallergen measurements in Houston, Texas
[PB-299643/7] N80-15697

AERODYNAMIC CHARACTERISTICS
Studies of non-linear aerodynamic characteristics of finned slender bodies at high angles of attack
[TAE-349] N80-15032

Applications of modern hydrodynamics to aeroacoustics. Part 1: Fundamental concepts and the most important theorems. Part 2: Applications
[NACA-116] N80-15034

Quiet Clean Short-haul Experimental Engine [QCSEE]. Aerodynamic and aeromechanical performance of a 50.8 cm [20 inch] diameter 1.34 PR variable pitch fan with core flow
[NASA-CR-135017] N80-15087

Aerodynamic characteristics of controls — conferences
[AGARD-CP-262] N80-15149

In-flight measured characteristics of combined flap-spoiler direct lift controls
N80-15165

Aerodynamic characteristics of moving trailing-edge controls at subsonic and transonic speeds
N80-15169

Unsteady aerodynamics of two-dimensional spoilers at low speeds
N80-15170

Aerodynamic interaction on a close-coupled canard wing configuration
N80-15175

On the effects of gaps on control surface characteristics
N80-15176

AERODYNAMIC COEFFICIENTS
The inertia coefficients of an airship in a frictionless fluid
[NACA-164] N80-15042

AERODYNAMIC CONFIGURATIONS
Quiet Clean Short-haul Experimental Engine [QCSEE]. The aerodynamic and mechanical design of the QCSEE under-the-wing fan
[NASA-CR-135009] N80-15109

An analytical and experimental study of a short s-shaped subsonic diffuser of a supersonic inlet
[NASA-TM-81406] N80-15134

Wind tunnel measurements and analysis of some unusual control surfaces on two swept wing fighter configurations
N80-15155

Roll control by digitally controlled segment spoilers
N80-15156

Wind tunnel investigation of controls for DF on a fighter-type configuration at higher angles of attack
N80-15166

Nonlinear aerodynamics of all-movable controls
N80-15173

Aerodynamic study of missile control surfaces
N80-15177

Conceptual design and performance estimates for a supersonic aerodynamic window for the ATA vacuum system aperture
[UCRL-15051] N80-15183

AERODYNAMIC DRAG
The mechanism of fluid resistance
N80-15035
The minimum induced drag of aerofoils
[NACA-121] N80-15038

AERODYNAMIC FORCES
Classical aerodynamic theory
[NASA-RP-1050] N80-15033
The aerodynamic forces on airship hulls
[NACA-184] N80-15039
Elements of the wing section theory and of the wing theory
[NACA-191] N80-15040
Flow and force equations for a body revolving in a fluid
[NACA-323] N80-15044
General theory of aerodynamic instability and the mechanism of flutter
[NACA-496] N80-15047
Exploratory studies of the cruise performance of upper surface blown configuration: Experimental program, high-speed force tests
[NASA-CR-159134] N80-15070
Exploratory studies of the cruise performance of upper surface blown configurations: Program analysis and conclusions
[NASA-CR-159136] N80-15072
AFFDL experience in active control technology
N80-15159
Problems of unsteady aerodynamics raised by the use of control surfaces as active controls
N80-15167

AERODYNAMIC HEATING
Aerodynamic heating on a multi-hundred watt heat source based on wind tunnel tests — for thermal simulation of reentry effects
[AD-A074312] N80-15056

AERODYNAMIC LOADS
CH-46 composite rotor blade flight stress survey data. Volume 3: Plotted forward rotor blade chord, torsion and airfoil loads
[AD-A075612] N80-15077
Analysis of low-speed helicopter flight test data
[AD-A074141] N80-15079

AERODYNAMIC STABILITY
General theory of aerodynamic instability and the mechanism of flutter
[NACA-496] N80-15047
Control considerations for CCV fighters at high angles of attack
N80-15160
Some investigations concerning the effects of gaps and vortex generators on elevator efficiency and of landing flap sweep on aerodynamic characteristics
N80-15178

AERODYNAMIC STALLING
A parametric wing design study for a modern laminar flow wing
[NASA-TM-80154] N80-15050

AERODYNAMICS
Aeronautical engineering. A continuing bibliography, supplement 115
[NASA-SP-7037[115]] N80-15027
Classical aerodynamic theory
[NASA-RP-1050] N80-15033
Theoretical aerodynamic methods for active control devices
N80-15150
A survey of experimental data on the aerodynamics of controls, in the light of future needs
N80-15151

AEROELASTICITY
An empirical approach for checking flutter stability of gliders and light aircraft
N80-15144

AERONAUTICAL ENGINEERING
Aeronautical engineering. A continuing bibliography, supplement 115
[NASA-SP-7037[115]] N80-15027
Documentation of the analysis of the benefits and costs of aeronautical research and technology models, volume 1
[NASA-CR-152278] N80-15065
Documentation of the Analyses of the Benefits and Costs of Aeronautical Research and Technology models [ABC-ART]. Volume 2: Appendices
[NASA-CR-152279] N80-15066
Bulletin of the Division of Mechanical Engineering and the National Aeronautical Establishment — design of a gas pipeline station control system and a railway switch car
[AD-A074885] N80-16022

AERONOMY
The chemistry of Venus' atmosphere
[NASA-CR-159951] N80-16011

AEROSOLS
Principles, calibration and process experience for a mass laser aerosol detector system
[BNL-25018] N80-15403
Western energy sulfate/nitrate monitoring network
[PB-299238/6] N80-15685
Photochemical aerosol dynamics
[PB-299212/1] N80-15695
Stratospheric aerosol modification by supersonic transport operations with climate implications
[NASA-RP-1058] N80-15726
Airborne studies of atmospheric aerosol in the High Plains and the structures of natural and artificially seeded clouds in eastern Montana
[PB-299026/5] N80-15770

AEROSPACE ENGINEERING
Solar power satellite system definition study. Volume 1: Executive summary
[NASA-CR-160442] N80-15195
Research and Technology Objectives and Plans Summary [RTOPS]. Research and Technology program, fiscal year 1980
[NASA-TM-80746] N80-15974

AEROSPACE ENVIRONMENTS
The course of experimental staphylococcus infection in albino mice during action of certain factors of space flight
[NASA-TM-75973] N80-15779

AEROSPACE MEDICINE
The course of experimental staphylococcus infection in albino mice during action of certain factors of space flight
[NASA-TM-75973] N80-15779
Aerospace medicine and biology: A continuing bibliography, supplement 200
[NASA-SP-701[200]] N80-15787
Results of medical studies during long-term manned flights on the orbital Salyut-6 and Soyuz complex
[NASA-TM-76019] N80-15797

AEROSPACE SCIENCES
Research and Technology Objectives and Plans Summary [RTOPS]. Research and Technology program, fiscal year 1980
[NASA-TM-80746] N80-15974
NASA publications
[NASA-TM-80852] N80-15980
Toward the endless frontier: History of the Committee on Science and Technology 1959 - 1979
[GPO-35-120] N80-15994

AEROSPACE TECHNOLOGY TRANSFER
The application test system: An approach to technology transfer — USDA aerospace and remote sensing information requirements
N80-15520

AFTERBURNING
Chemical aspects of afterburner systems
[PB-298465/6] N80-15684

AGING [MATERIALS]
Aging behavior of alloy 800H and associated mechanical property changes — for nuclear reactors
[GA-A-15196] N80-15251

AGRICULTURE
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
LACIE large area acreage estimation — United States of America
N80-15453
Application of LANDSAT digital data for monitoring drought — South Dakota
N80-15483
Feature extraction applied to agricultural crops as seen by LANDSAT
N80-15497
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] N80-15527
Remote sensing of agricultural resources. A bibliography with abstracts
[NTIS/PS-79/0993/0] N80-15542
Obtaining timely crop area estimates using ground-gathered and LANDSAT data
[PB-300825/7] N80-15549

AGROMETEOROLOGY
Development of LACIE CCEA-1 weather/wheat yield models — regression analysis
N80-15457

AIR
Houston area oxidant study detailed hydrocarbon analyses
[PB-299629/6] N80-15674

AIR COOLING
Design of duplex low-carbon steels with carbide forming elements
[LBL-8628] N80-15244
Computer program for generating input for analysis of impingement-cooled, axial-flow turbine blade
[NASA-TP-1603] N80-15361

AIR POLLUTION
Quiet Clean Short-haul Experimental Engine [QCSEE] clean combustor test report
[NASA-CR-134916] N80-15104
Study of the nature of ozone, oxides of nitrogen, and nonmethane hydrocarbons in Tulsa, Oklahoma. Volume 1: Project description and data summaries
[PB-300481/9] N80-15229
Coal sulfur measurements
[PB-299575/1] N80-15294
Sulfur fixation during coal gasification — desulfurizing to reduce air pollution
[PB-301304/6] N80-15296
Effects of inspection and maintenance programs on fuel economy
[PB-297583/7] N80-15420
Survey of statistical techniques used in validation studies of air pollution prediction models
[COO-2874-50] N80-15665
Man's effect on stratospheric ozone
[UCRL-82556] N80-15666
Captive air bag design study — The relationship between oxidant concentrations in air and precursor levels
[PB-299636/1] N80-15673
Analytical diffusion model for long distance transport of air pollutants
[PB-299356/2] N80-15675
Environmental assessment report: Solvent Refined Coal [SRC] systems
[PB-300383/7] N80-15676
The Beryllium-7 program of the Houston area oxidants study
[PB-299632/9] N80-15678
Socio-economic impact analysis of selected air pollution controls in the Houston-Galveston region
[PB-299635/3] N80-15679
An analysis of atmospheric visibility data in the Houston area
[PB-299633/7] N80-15680
EPA utility FGD [Flue Gas Desulfurization] survey: December 1978 - January 1979 — electric power plants
[PB-299399/6] N80-15682
Chemical aspects of afterburner systems
[PB-298465/6] N80-15684
In-stack plume opacity from electrostatic precipitator/scrubber system at Harrington Unit 1
[PB-299215/4] N80-15686
Pilot scale evaluation of NOx combustion control for pulverized coal, phase 2
[PB-299325/1] N80-15687
Management of coal preparation fine wastes without disposal ponds
[PB-299100/8] N80-15691
Inventory of resources with emissions greater than 100 tons/year subject to organic material regulations in metropolitan Boston AQCR
[PB-298879/8] N80-15692
The cost of clean air and water report to Congress
[PB-300446/2] N80-15693
Photochemical aerosol dynamics
[PB-299212/1] N80-15695
Statistical analysis of the source-receptor relationships for ozone and haze in the Houston area
[PB-299634/6] N80-15696
Investigation of the effects of the installation of an oxidation catalyst on a diesel powered vehicle
[PB-299928/2] N80-15699
Compliance status of major air pollution facilities
[PB-299959/7] N80-15700
Evaluation of stationary source particulate measurement methods. Volume 3: Secondary lead smelters
[PB-300337/3] N80-15701
Evaluation of particulate emission factors for vehicle tire wear
[PB-300443/9] N80-15702
Global observation of atmospheric ozone by satellite
[UCRL-82028] N80-15720
Meteorological effects of oil refinery operations in Los Angeles
[PB-300720/0] N80-15758

AIR QUALITY
Environmental overview of geothermal development: The Geysers-Calistoga KGRA. Volume 1: Issues and recommendations
[UCRL-52496-VOL-1] N80-15626
Air quality monitor and acid rain networks
N80-15659
Contaminants — physiological effects of spacecraft contaminants
N80-15790

AIR SAMPLING
Ground-based measurements of DM-2 rocket exhaust effluents using fixed-flow samplers and electrets
N80-15654
Airborne aeroallergen measurements in Houston, Texas
[PB-299643/7] N80-15697

AIR TO SURFACE MISSILES
Control integration technology impact — as a basis for improving the combat effectiveness of all tactical aircraft
N80-15162

AIR TRANSPORTATION
Aircraft delays at major US airports can be reduced
[PB-299442/4] N80-15061
Circadian rhythms in air operations
N80-15816

AIR WATER INTERACTIONS
Woods Hole Oceanographic Institution Collection of Climatology and Air/Sea Interaction [CASI] data
[AD-A075009] N80-15729
A model of diurnal variability of the ocean-atmosphere system in the undisturbed trade wind regime
[AD-A073540] N80-15749
Atmospheric structural variations that result in upwelling off Oregon
[PB-301240/8] N80-15768

AIRBORNE EQUIPMENT
Technical papers on airborne laser hydrography
[PB-299321/0] N80-15546

AIRBORNE SURVEILLANCE RADAR
Possible methods for distinguishing icebergs from ships by aerial remote sensing
[NASA-TM-79310] N80-15538
AIRBORNE/SPACEBORNE COMPUTERS
On-board multispectral classification study. Volume 2: Supplementary tasks — adaptive control
[NASA-CR-159178] N80-15539
AIRCRAFT ACCIDENT INVESTIGATION
A first look at the effect of severe rainfall upon an aircraft
[NASA-CR-162569] N80-15058
AIRCRAFT ACCIDENTS
Some human factors issues in the development and evaluation of cockpit alerting and warning systems
[NASA-RP-1055] N80-15821
AIRCRAFT COMPARTMENTS
Simultaneous cabin and ambient ozone measurements on two Boeing 747 airplanes, volume 1
[NASA-TM-79166] N80-15059
A study of partial coherence for identifying interior noise sources and paths on general aviation aircraft
[NASA-TM-80197] N80-15874
AIRCRAFT CONFIGURATIONS
A conceptual design of a lighter-than-air test and research vehicle
[AD-A074760] N80-15053
Exploratory studies of the cruise performance of upper surface blown configuration: Experimental program, high-speed force tests
[NASA-CR-159134] N80-15070
Exploratory studies of the cruise performance of upper surface blown configurations: Experimental program, high-speed pressure tests
[NASA-CR-159135] N80-15071
Hypersonic cruise aircraft propulsion integration study, volume 1
[NASA-CR-158926-VOL-1] N80-15074
Hypersonic cruise aircraft propulsion integration study, volume 2
[NASA-CR-158926-VOL-2] N80-15075
Flight control and configuration design considerations for highly maneuverable aircraft
N80-15154
AIRCRAFT CONSTRUCTION MATERIALS
Composite structural materials
[NASA-CR-162578] N80-15076
Climatic chamber testing aircraft, engines armament and avionics; Test operations procedure — environmental test chambers and facility for testing aircraft construction materials and engines
[AD-A074049] N80-15181
AIRCRAFT CONTROL
Analyses and tests of the B-1 aircraft structural mode control system
[NASA-CR-144887] N80-15073
Aerodynamic characteristics of controls — conferences
[AGARD-CP-262] N80-15149
Theoretical aerodynamic methods for active control devices
N80-15150
A survey of experimental data on the aerodynamics of controls, in the light of future needs
N80-15151
Correlation of F-15 flight and wind tunnel test control effectiveness
N80-15152
Flight control and configuration design considerations for highly maneuverable aircraft
N80-15154
Direct side force and drag control with the aid of pylon split flaps
N80-15163
Wind tunnel investigation of controls for DF on a fighter-type configuration of higher angles of attack
N80-15166
Problems of unsteady aerodynamics raised by the use of control surfaces as active controls
N80-15167
Forebody vortex blowing: A novel control concept to enhance departure/spin recovery characteristics of fighter and trainer aircraft
N80-15172
Nonlinear aerodynamics of all-movable controls
N80-15173
AIRCRAFT DESIGN
A conceptual design of a lighter-than-air test and research vehicle
[AD-A074760] N80-15053
Exploratory studies of the cruise performance of upper surface blown configurations: Program analysis and conclusions
[NASA-CR-159136] N80-15072
JA-6A circulation control wing contractor flight demonstration
[AD-A074888] N80-15080
AIRCRAFT ENGINES
Quiet Clean Short-haul Experimental Engine (QCSEE). Double-annular clean combustor technology development report
[NASA-CR-159483] N80-15121
Computer simulation of engine systems
[NASA-TM-79290] N80-15132
Climatic chamber testing aircraft, engines armament and avionics; Test operations procedure — environmental test chambers and facility for testing aircraft construction materials and engines
[AD-A074049] N80-15181
AIRCRAFT EQUIPMENT
Aircraft anti-icing/de-icing
[AD-A074128] N80-15078
AIRCRAFT HAZARDS
Simultaneous cabin and ambient ozone measurements on two Boeing 747 airplanes, volume 1
[NASA-TM-79166] N80-15059
AIRCRAFT INSTRUMENTS
Development of a high-voltage linear actuator amplifier system
[AD-A074246] N80-15343
AIRCRAFT LANDING
Landing approach airframe noise measurements and analysis
[NASA-TP-1602] N80-15028
AIRCRAFT MAINTENANCE
Fleet hardness variation — to determine aircraft survivability due to blast loads
[AD-A074849] N80-15029
AIRCRAFT MANEUVERS
Maneuvering aircraft: Noise pollution and control, volume 2. A bibliography with abstracts
[NTIS/PS-79/0973/2] N80-15671
AIRCRAFT MODELS
Evaluation of the aerodynamic characteristics of a 1/20-scale A-10 model at Mach numbers from 0.30 to 0.75
[AD-A074867] N80-15055
AIRCRAFT NOISE
Landing approach airframe noise measurements and analysis
[NASA-TP-1602] N80-15028
Acoustic analysis of aft noise reduction techniques measured on a subsonic tip speed 50.8 cm [twenty inch] diameter fan — quiet engine program
[NASA-CR-134891] N80-15102
Maneuvering aircraft: Noise pollution and control, volume 2. A bibliography with abstracts
[NTIS/PS-79/0973/2] N80-15671
A study of partial coherence for identifying interior noise sources and paths on general aviation aircraft
[NASA-TM-80197] N80-15874
A summary and evaluation of semi-empirical methods for the prediction of helicopter rotor noise
[NASA-TM-80200] N80-15875
AIRCRAFT PERFORMANCE
A first look at the effect of severe rainfall upon an aircraft
[NASA-CR-162569] N80-15058
AIRCRAFT SAFETY
NASA technical advances in aircraft occupant safety — clear air turbulence detectors, fire resistant materials, and crashworthiness
[NASA-TM-80851] N80-15060
AIRCRAFT SPECIFICATIONS
Low cost aircraft flutter clearance — conference
[AGARD-CP-278] N80-15141
Comparison of international flutter requirements and flutter freedom substantiation of light aircraft in the USA
N80-15142
The state-of-the-art of flutter substantiation procedures among US general aviation manufacturers
N80-15143
Dynamic identification of light aircraft structures and their flutter certification
N80-15145
The minimum cost approach to flutter clearance
N80-15148
AIRCRAFT STRUCTURES
Applications of modern hydrodynamics to aeronautics. Part 1: Fundamental concepts and the most important theorems. Part 2: Applications
[NACA-116] N80-15034
The aerodynamic forces on airship hulls
[NACA-184] N80-15039
A conceptual design of a lighter-than-air test and research vehicle
[AD-A074760] N80-15053
Evaluation of approximate methods for the prediction of noise shielding by airframe components
[NASA-TP-1004] N80-15129
Dynamic identification of light aircraft structures and their flutter certification
N80-15145
Response of nonlinear structural panels subjected to high intensity noise
[AD-A074986] N80-15432
AIRCRAFT SURVIVABILITY
Fleet hardness variation — to determine aircraft survivability due to blast loads
[AD-A074849] N80-15029
AIRFOIL PROFILES
Classical aerodynamic theory
[NASA-RP-1050] N80-15033
Pressure distribution on Joukowski wings
[NACA-TM-336] N80-15036
Graphic construction of Joukowski wings
[NACA-TM-336] N80-15037
The minimum induced drag of aerofoils
[NACA-121] N80-15038
AIRFOILS
Computer program to prepare airfoil characteristic data for use in helicopter performance calculations
[NASA-TM-78627] N80-15031
The minimum induced drag of aerofoils
[NACA-121] N80-15038
A users guide for A344: A program using a finite difference method to analyze transonic flow over oscillating airfoils
[NASA-CR-159141] N80-15052
AIRFRAME MATERIALS
Documentation of the analysis of the benefits and costs of aeronautical research and technology models, volume 1
[NASA-CR-152278] N80-15865
Documentation of the Analyses of the Benefits and Costs of Aeronautical Research and Technology models [ABC-ART]. Volume 2: Appendices
[NASA-CR-152279] N80-15866
AIRFRAMES
Landing approach airframe noise measurements and analysis
[NASA-TP-1602] N80-15028
AIRGLOW
Airborne all-sky imaging of equatorial airglow
[AD-A073716] N80-15717
AIRPORTS
Aircraft delays at major US airports can be reduced
[PB-299442/4] N80-15061
AIRSHIPS
The aerodynamic forces on airship hulls
[NACA-184] N80-15039
The inertia coefficients of an airship in a frictionless fluid
[NACA-164] N80-15042
A conceptual design of a lighter-than-air test and research vehicle
[AD-A074760] N80-15053
AIRSPEED
A flutter-speed formula for wings of high aspect ratio
N80-15147
ALERTNESS
Vigilance and attention
N80-15811
ALEUTIAN ISLANDS [US]
US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft: Aleution Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain
[PB-297931/8] N80-15547
ALGAE
Value of crops. Quantity, quality and cost price — algae as a nutritional supplement
[NASA-TM-75925] N80-15537
Use of indicator species of algae to determine water quality
[PB-299953/0] N80-15694
Comparison of diurnal fluctuations of dissolved inorganic carbon and algal productivity estimates in an oligotrophic and mesotrophic freshwater environment
[PB-301201/0] N80-15785
ALGORITHMS
An in-depth study of the sensitivity of wave digital filters
[AD-A073962] N80-15338
CLASSY: An adaptive maximum likelihood clustering algorithm
N80-15495
Methods of extending crop signatures from one area to another
N80-15500
A differential dynamic programming algorithm for the solution of the three-dimensional optimal missile avoidance
[TAE-351] N80-15835
PRIME and PDQ sorts: Efficient minimal storage sorting algorithms
[AD-A073567] N80-15841
Linear multiple objective problems with interval coefficients
[AD-A073967] N80-15975
ALL SKY PHOTOGRAPHY
Airborne all-sky imaging of equatorial airglow
[AD-A073716] N80-15717
ALLOYS
Local electronic properties of dilute magnetic alloys
[SAN-0034-T4] N80-15966
ALPHA JET AIRCRAFT
Roll control by digitally controlled segment spoilers
N80-15156
Direct side force and drag control with the aid of pylon split flaps
N80-15163
ALUMINUM
Energy absorption mechanisms during crack propagation in metal matrix composites
[NASA-CR-162574] N80-15232
Technical barriers to the reuse of aluminum recovered from municipal refuse
[PB-300436/3] N80-15261
Theory of low dimensional superconductors
[SAN-0034-T5] N80-15354
Qualification of aluminum for OTEC heat exchangers
[ANL/OTEC-BCM-003] N80-15573
Development of Li-Al/FeS cells with LiCl-rich electrolyte
[CONF-7810135-2] N80-15614

ALUMINUM ALLOYS
High-strength aluminum-magnesium alloys: Thermomechanical processing, microstructure and tensile mechanical properties
[AD-A074185] N80-15230
Alternate immersion stress corrosion testing of 5083 aluminum
[RFP-2645] N80-15257
ALUMINUM OXIDES
Gold plating metallized alumina ceramics
[GEPP-TIS-390] N80-15254
AMERICIUM
Treatment of Am 355 steel for adhesive bonding
[AD-A074113] N80-15236
AMINO ACIDS
The crystal structure and variable temperature Se-119m Mossbauer study of trimethylin glycinate, a one-dimensional, amino-bridged polymer
[AD-A074383] N80-15955
AMORPHOUS SEMICONDUCTORS
Modifications in optoelectronic behavior of plasma-deposited amorphous semiconductor alloys via impurity incorporation
[BNL-26646] N80-15255
AMPLIFIER DESIGN
Phased array antenna amplifier exploratory development model
[AD-A074961] N80-15315
AMPLIFIERS
Very fast, high-peak-power, planar triode amplifiers for driving optical gates
[UCRL-82538] N80-15358
ANAEROBES
Fast production of methane by anaerobic digestion. Volume 2: Appendices
[COO-2900-17-VOL-2] N80-15283
ANALOG DATA
Geometric design technique for two-dimensional analog and digital filters
[AD-A077967] N80-15334
ANALOG SIMULATION
Space construction base control system
[NASA-CR-161553] N80-15194
ANALYSIS OF VARIANCE
Estimation of variance components
[AD-A074223] N80-15867
ANALYTICAL CHEMISTRY
Mass and emissions spectrometry in the Analytical Chemistry Division of Oak Ridge National Laboratory
[ORNL/TM-6485] N80-15226
ANDESITE
Geologic application of thermal inertia imaging using HCMM data — Cuprite, Elko, and Gollfield test areas, Nevada
[E80-10035] N80-15529
ANECHOIC CHAMBERS
Evaluation of approximate methods for the prediction of noise shielding by airframe components
[NASA-TP-1004] N80-15129
ANGLE OF ATTACK
Control considerations for CCV fighters at high angles of attack
N80-15160
Wind tunnel investigation of controls for DF on a fighter-type configuration of higher angles of attack
N80-15166
Nonlinear aerodynamics of all-movable controls
N80-15173
ANGULAR DISTRIBUTION
SNEX: Semianalytic solution of the one-dimensional discrete ordinates [S/sub n] transport equations with diamond differenced angular fluxes
[LA-7879-MS] N80-15856
Bifurcation and stability in Yang-Mills theory with sources
[COO-3069-455] N80-15971
ANGULAR MOMENTUM
Angular momentum and the collective modes excited in deep-inelastic processes and in fission
[LBL-9175] N80-15904
ANNEALING
Low temperature electron irradiation and annealing of pure cadmium
[COO-1198-1274] N80-15246
Radiation damage annealing mechanisms and possible low temperature annealing in silicon solar cells
[NASA-TM-81392] N80-15550
ANODIZING
Treatment of Am 355 steel for adhesive bonding
[AD-A074113] N80-15236
ANTARCTIC REGIONS
Daily high-latitude 150 mb pressure maps from Twerle [Tropical Wind, reference level and energy conversion experiment] and rawinsondes. *Part 1: 16 November 1975 - 31 January 1976*
[PB-301343/0] N80-15766
ANTENNA ARRAYS
Power optimization in adaptive array: A technique for interference protection
[AD-A074429] N80-15311
Phased array antenna amplifier exploratory development model
[AD-A074961] N80-15315
ANTENNA DESIGN
Experimental loop antennas for 60 KHz to 200 KHz
[NASA-CR-162729] N80-15063
ANTENNA RADIATION PATTERNS
Antenna sidelobe and interference reduction. A bibliography with abstracts
[NTIS/PS-79/1033/6] N80-15325
Horn antennas. Citations from the International Aerospace Abstracts data base
[NTIS/PS-79/1018/5] N80-15326
ANTIGENS
Airborne aeroallergen measurements in Houston, Texas
[PB-299643/7] N80-15697
ANTIICING ADDITIVES
Aircraft anti-icing/de-icing
[AD-A074128] N80-15078
ANTIPARTICLES
Quantum mechanics with applications to quarkonium — Schroedinger equation
[COO-1764-360] N80-15970
ANTISEPTICS
Waste stabilization lagoon microorganism removal efficiency and effluent disinfection with chlorine
[PB-300631/9] N80-15786
Progress in wastewater disinfection technology — conference
[PB-299338/4] N80-16001
APERTURES
Electromagnetic transmission through an annular aperture in an infinite conducting screen
[AD-A074831] N80-15320
APPLICATIONS PROGRAMS [COMPUTERS]
Minicomputers, volume 2. A bibliography with abstracts
[NTIS/PS-79/0978/1] N80-15832
APPROXIMATION
Evaluation of approximate methods for the prediction of noise shielding by airframe components
[NASA-TP-1004] N80-15129
Theory of chemical kinetics — franck-condon approximation
[COO-2873-3] N80-15223
Numerical methods for Helmholtz type equations in unbounded regions
[BNL-26543] N80-15858
Scaled hydrogenic approximation wave functions
[UCID-18167] N80-15881
Obtaining numerical values for the elliptic emission functions used in calculating electron emission from surfaces
[GEPP-TIS-443] N80-15961
AQUIFERS
Aquifer thermal energy storage
[LBL-7070] N80-15618
ARCHAEOLOGY
Intensive archeological survey of a potential defense waste processing facility site, Savannah River Plant, Aiken and Barnwell Counties, South Carolina. Research manuscript series 149
[DOE/SR-01072-3] N80-15913
Intensive archeological survey of a potential independent spent fuel storage facility, Savannah River Plant, Aiken and Barnwell Counties, South Carolina, research manuscript series 141
[DOE/SR-01072-1] N80-15914
ARCHITECTURE
Design of residential buildings utilizing natural thermal storage
[DOE/TIC-10143] N80-15302
ARCHITECTURE [COMPUTERS]
A look at computer system selection criteria
N80-15480
Cost and performance characteristics of data system configurations for processing remotely sensed data
N80-15481
The design and implementation of an inexpensive microprocessor development system for the Z-80 microprocessor
[AD-A073927] N80-15829
VTS processing display subsystem design — to prevent environmental damage in harbor areas
[AD-A074053] N80-15830
Problems in processing multiscreal video information at specialized complexes
[NASA-TM-75919] N80-15837
Programming language design. A bibliography with abstracts
[NTIS/PS-79/0979/9] N80-15850
Syntetic priority queues
[AD-A074494] N80-15852
ARIZONA
Statistical summaries of Arizona streamflow data
[PB-299354/1] N80-15550
Arizona cool season climatological surface wind and pressure gradient study
[PB-298900/2] N80-15762
ARMATURES
PULSAR: An inductive pulse power source
[SAND-79-1246C] N80-15627
ARTIFICIAL INTELLIGENCE
Decision making and problem solving with computer assistance
[NASA-TM-78008] N80-15973
ARTIFICIAL SATELLITES
Differential orbit correction for near-stationary artificial satellites
[AD-A074231] N80-15196
ASCENT TRAJECTORIES
Simple computations for near-optimum ascent and short maneuver targets and deorbit ignition time
[NASA-TM-80850] N80-15185
ASSEMBLER ROUTINES
LACIE/ERIPS software system summary
N80-15477
Utility and math subroutines for the M6800 microprocessor
[MLM-2564] N80-15847
ASSESS PROGRAM
Airborne measurements of solar and planetary near ultraviolet radiation during the NASA/ESA CV-900 spacelab simulation
[NASA-CR-162566] N80-16012
ASTROPHYSICS
Studies in astronomical time series analysis: Modeling random processes in the time domain
[NASA-TM-81148] N80-15854
ATLANTIC OCEAN
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] N80-15526
Trace element geochemistry of the South Atlantic bight
[DOE/EV-00890-3] N80-15774
Analysis and interpretation of tidal currents in the coastal boundary layer — Middle Atlantic Bight
[PB-299428/3] N80-15775
ATMOSPHERIC ATTENUATION
Atmospheric effects on laser beams, volume 2. A bibliography with abstracts
[NTIS/PS-79/0981/5] N80-15409
ATMOSPHERIC BOUNDARY LAYER
TWINDX: A planetary boundary layer model for the winds in extratropical and tropical ocean areas
[AD-A074337] N80-15732
The dynamics of material layers
[AD-A073728] N80-15740
Northwest New Mexico boundary layer experiment
[LA-7525-MS] N80-15751
An analysis of clear air planetary boundary layer wind synthesized from NSSL's dual Doppler-radar data
[PB-300865/3] N80-15755
Arizona cool season climatological surface wind and pressure gradient study
[PB-298900/2] N80-15762
ATMOSPHERIC CHEMISTRY
Analysis of the measured effects of the principal exhaust effluents from solid rocket motors
[NASA-CR-3136] N80-15660
Interpretation of NO and OH emission from 1976 airborne measurements
[AD-A073898] N80-15661
Photochemical aerosol dynamics
[PB-299212/1] N80-15695
Chemical Kinetic Data Needs for Modeling the Lower Troposphere
[PB-299439/0] N80-15722
The chemistry of Venus' atmosphere
[NASA-CR-159951] N80-16011
ATMOSPHERIC CIRCULATION
Moisture advection and the Sangster chart
[AD-A073432] N80-15744
ATMOSPHERIC COMPOSITION
Pressure Modulator Radiometer [PMR] tests
[NASA-CR-159175] N80-15380
ATMOSPHERIC DENSITY
Rocketborne laser backscatter experiment
[AD-A073853] N80-15398
Time and space variation of density in the tropics
[AD-A074472] N80-15714
ATMOSPHERIC DIFFUSION
Analytical diffusion model for long distance transport of air pollutants
[PB-299356/2] N80-15675
Mixing in billow turbulence and stratospheric eddy diffusion
[AD-A074466] N80-15715
Diffusion coefficients from Metrac system turbulence measurements
[PB-300339/9] N80-15763
ATMOSPHERIC EFFECTS
Stratospheric aerosol modification by supersonic transport operations with climate implications
[NASA-RP-1058] N80-15726
ATMOSPHERIC ELECTRICITY
Birkeland currents and ring currents in the computer simulation of the substorm of 19 September 1976
[AD-A073852] N80-15712
Storm research
[PB-300299/5] N80-15760
ATMOSPHERIC MODELS
Acid rain: Mesoscale model
N80-15655
Acid rain: Microphysical model
N80-15656
Survey of statistical techniques used in validation studies of air pollution prediction models
[COO-2874-50] N80-15665
Numerical modeling of baroclinic instability
[NASA-CR-161363] N80-15706
A global ionospheric model
[AD-A074370] N80-15709
Modeling the refractive index structure parameter in the marine planetary boundary layer
[AD-A074275] N80-15710
Chemical Kinetic Data Needs for Modeling the Lower Troposphere
[PB-299439/0] N80-15722

Summer fellowship in scientific computing
[PB-301297/8] N80-15724
Investigation of models for large-scale meteorological prediction experiments
[NASA-CR-162572] N80-15728
The dynamics of material layers
[AD-A073728] N80-15740
ATMOSPHERIC MOISTURE
Moisture advection and the Sangster chart
[AD-A073432] N80-15744
Precipitable water over the United States. Volume 2: Semimonthly maxima
[PB-300870/3] N80-15753
ATMOSPHERIC PHYSICS
Active experiments using rocket-borne shaped charge barium releases — solar-terrestrial magnetospheric physics
[NASA-CR-162581] N80-15708
Extremely high latitude auroras, part 1
[AD-A074989] N80-15711
Time and space variation of density in the tropics
[AD-A074472] N80-15714
Summer fellowship in scientific computing
[PB-301297/8] N80-15724
ATMOSPHERIC PRESSURE
Daily high-latitude 150 mb pressure maps from Twerle [Tropical Wind, reference level and energy conversion experiment] and rawinsondes. Part 1: 16 November 1975 - 31 January 1976
[PB-301343/0] N80-15766
ATMOSPHERIC RADIATION
An atmospheric temperature profile measured with an in-situ infrared radiometer
[AD-A074471] N80-15713
ATMOSPHERIC REFRACTION
Modeling the refractive index structure parameter in the marine planetary boundary layer
[AD-A074275] N80-15710
ATMOSPHERIC SCATTERING
Compensation for atmospheric effects in LANDSAT data N80-15498
ATMOSPHERIC TEMPERATURE
Input data for solar systems
[DOE/TIC-10195] N80-15580
An atmospheric temperature profile measured with an in-situ infrared radiometer
[AD-A074471] N80-15713
The effect of inaccuracies in meteorological parameters on one-dimensional forecasts of upper ocean thermal structure
[AD-A073539] N80-15748
ATMOSPHERIC TURBULENCE
Clear air turbulence. A bibliography with abstracts
[NTIS/PS-79/0972/4] N80-15752
Diffusion coefficients from Metrac system turbulence measurements
[PB-300339/9] N80-15763
ATOMIC COLLISIONS
Fast numerical calculations of ion-atom collisions
[CONF-7905111-1] N80-15880
Some features of Rayleigh scattering from light atoms and ions
[UCRL-15046] N80-15886
ATOMIC ENERGY LEVELS
Multiconfiguration Hartree-Fock method for atomic energy levels and transition probabilities
[COO-4264-3] N80-15884
ATOMIC STRUCTURE
Multiconfiguration Hartree-Fock method for atomic energy levels and transition probabilities
[COO-4264-3] N80-15884
Fermi surface measurements in A-15 compounds
[CONF-790653-13] N80-15960
Electronic structure of defects in oxides
[ORO-4837-6] N80-15967
ATTENTION
Vigilance and attention N80-15811
ATTENUATION COEFFICIENTS
CTS attenuation and cross polarization measurements at 11.7 GHz
[NASA-CR-159952] N80-15308
ATTITUDE CONTROL
Space construction base control system
[NASA-CR-161353] N80-15194
AUGER SPECTROSCOPY
Auger lineshape analysis of molecules and solids
[SAND-79-1240C] N80-15956
AURORAS
Interpretation of NO and OH emission from 1976 airborne measurements
[AD-A073898] N80-15661
Extremely high latitude auroras, part 1
[AD-A074989] N80-15711
AUSTENITIC STAINLESS STEELS
Nitrogen-strengthened austenitic stainless steel for cryogenic magnet structures
[CONF-790815-13] N80-15258
AUTOMATED GUIDEWAY TRANSIT VEHICLES
New transportation systems and technology, 1979: Transportation research record 708
[PB-300747/3] N80-16000
AUTOMOBILE ACCIDENTS
Experimental evaluation of a portable energy absorbing system for highway service vehicles
[PB-299168/5] N80-15419
AUTOMOBILE ENGINES
Effects of inspection and maintenance programs on fuel economy
[PB-297583/7] N80-15420
AUTOMOBILE FUELS
Project planning document: High vechicle Alternative Fuels Utilization Program [AFUP]
[DOE/CS-0093] N80-15279
Ethanol/gasoline blends as automotive fuels
[CONF-790520-5] N80-15280
AUTOREGRESSIVE PROCESSES
ARMA models for earthquake ground motions — California
[UCRL-15046] N80-15719
AVALANCHE DIODES
Two-dimensional avalanche breakdown in Pt-Si Schottky barrier diodes
[AD-A075010] N80-15954
AVIONICS
Care 3, Phase 1, volume 1
[NASA-CR-159122] N80-15423
Care 3, phase 1, volume 2
[NASA-CR-159123] N80-15424
AXIAL FLOW TURBINES
Computer program for generating input for analysis of compressor-cooled, axial-flow turbine blade
[NASA-TP-1603] N80-15361
AXIAL LOADS
A theory of thermoviscoplasticity for uniaxial mechanical and thermal loading
[AD-A074957] N80-15431
Mitigating effects in the plastic failure of shells subjected to axially dependent dynamic pressure loadings
[COO-4122-27] N80-15443
AXIAL STRAIN
Effect of point defects on mechanical properties of metals
[COO-1367-97] N80-15245
AXISYMMETRIC BODIES
Numerical prediction of flows over and in the near wake behind axisymmetric, self-propelled bodies
[AD-A074971] N80-15371
User's guide for a system of computer programs to predict flows over and in the near wake behind axisymmetric, self-propelled bodies
[AD-A074972] N80-15372
HONDO II: A finite element computer program for the large deformation dynamic response of axisymmetric solids
[SAND-78-0422] N80-15442

B

B-1 AIRCRAFT
Analyses and tests of the B-1 aircraft structural mode control system
[NASA-CR-144887] N80-15073
BACTERIA
Charge separation in synthetic photo-reaction centers
[CONF-781048-1] N80-15784
BALL BEARINGS
Evaluation of worn SSME low pressure liquid oxygen turbopump bearing
[NASA-CR-161367] N80-15412
Evaluation of 100 mm bore bearings after accelerated testing in a simulated space environment
[AD-A074527] N80-15413
BALLOON SOUNDING
An atmospheric temperature profile measured with an in-situ infrared radiometer
[AD-A074471] N80-15713
BANACH SPACE
Regularity of solutions to an inhomogeneous differential equation in Banach space
[CONF-7906102-1] N80-15862
Equivalence between resolvent consistency and convergence for nonlinear quasi-contractive algorithms
[ANL-79-53] N80-15863
BAND STRUCTURE OF SOLIDS
Auger lineshape analysis of molecules and solids
[SAND-79-1240C] N80-15956
BARITE
Geologic application of thermal inertia imaging using HCMM data — Cuprite, Elko, and Goldfield test areas, Nevada
[E80-10035] N80-15529
BARIUM
Active experiments using rocket-borne shaped charge barium releases — solar-terrestrial magnetospheric physics
[NASA-CR-162581] N80-15708
BAROCLINIC WAVES
Numerical modeling of baroclinic instability
[NASA-CR-161363] N80-15706
BAROCLINITY
Baroclinic instability with variable gravity: A perturbation analysis
[NASA-TP-1586] N80-15445
BARRIERS
Experimental evaluation of a portable energy absorbing system for highway service vehicles
[PB-299168/5] N80-15419
BASIC [PROGRAMMING LANGUAGE]
REBEL/BASIC: Language, a user's guide
[UCRL-52668] N80-15849
BATHYMETERS
Technical papers on airborne laser hydrography
[PB-299321/6] N80-15546
BAYES THEOREM
On evaluating clustering procedures for use in classification N80-15494
BEACHES
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] N80-15526
BEAMS [SUPPORTS]
The effect of initial twist on the torsional rigidity of beams: Another point of view
[TAE-360] N80-15427
BED REST
Joint Soviet-American experiment on hypokinesia: Experimental results
[NASA-TM-76013] N80-15796
BEDS [PROCESS ENGINEERING]
Evaluation of granular bed filters for high-temperature/high-pressure particulate control — pollution control
[PB-299195/8] N80-15672
BEHAVIOR
Influence of hypokinesis on physiological functions in fox-I
[NASA-TM-75999] N80-15778
BENDING DIAGRAMS
Inelastic analysis of transverse deflection of plates by the boundary element method
[COO-2733-24] N80-15438
BENEFICIATION
Management of coal preparation fine wastes without disposal ponds
[PB-299100/8] N80-15691
BERYLLIUM 7
The Beryllium-7 program of the Houston area oxidants study
[PB-299632/0] N80-15678
BIBLIOGRAPHIES
Aeronautical engineering. A continuing bibliography, supplement 115
[NASA-SP-7037[115]] N80-15027
Titanium and titanium alloy creep. A bibliography with abstracts
[NTIS/PS-79/0984/9] N80-15260
High temperature lubricants and oils, volume 2. Citations from the Engineering Index data base
[NTIS/PS-79/1032/6] N80-15274
Antenna sidelobe and interference reduction. A bibliography with abstracts
[NTIS/PS-79/1013/6] N80-15325
Horn antennas. Citations from the International Aerospace Abstracts data base
[NTIS/PS-79/1018/5] N80-15326
Light communication systems, volume 3. A bibliography with abstracts
[NTIS/PS-79/0998/9] N80-15327
Atmospheric effects on laser beams, volume 2. A bibliography with abstracts
[NTIS/PS-79/0981/5] N80-15409
Laser welding. Citations from the Engineering Index data base — bibliography with abstracts
[NTIS/PS-79/1028/4] N80-15418
Remote sensing of agricultural resources. A bibliography with abstracts
[NTIS/PS-79/0993/0] N80-15542
Maneuvering aircraft: Noise pollution and control, volume 2. A bibliography with abstracts
[NTIS/PS-79/0973/2] N80-15671
Atmospheric echo sounding. A bibliography with abstracts
[NTIS/PS-79/0989/8] N80-15721
Clear air turbulence. A bibliography with abstracts
[NTIS/PS-79/0972/4] N80-15752
Aerospace medicine and biology: A continuing bibliography, supplement 200
[NASA-SP-7011[200]] N80-15787
Biological effects of high-voltage electric fields, an update. Volume 2: Bibliography
[EPRI-EA-1123-VOL-2] N80-15801
Minicomputers, volume 2. A bibliography with abstracts
[NTIS/PS-79/0978/1] N80-15832
Programming language design. A bibliography with abstracts
[NTIS/PS-79/0979/9] N80-15850
Fiber optics, volume 3. A bibliography with abstracts
[NTIS/PS-79/1006/0] N80-15924
Management by objectives. A bibliography with abstracts
[NTIS/PS-79/0958/3] N80-15976
On-line information retrieval systems, volume 2: A bibliography with abstracts
[NTIS/PS-79/0971/6] N80-15990
Reports of planetary geology program, 1979 - 1980 — bibliographies
[NASA-TM-81776] N80-16010
BINARY ALLOYS
Adhesion and friction of iron-base binary alloys in contact with silicon carbide in vacuum
[NASA-TP-1604] N80-15234

BINARY CODES
Synthesis of spread spectrum signals from the non-binary Galois field
[AD-A078606] N80-15312
BINOCULARS
Daytime visual acuity of observers through a window with and without binoculars
[AD-A074722] N80-15800
BIOASSAY
Biological screening of complex samples from industrial/energy processes
[PB-300450/5] N80-15805
BIOCHEMISTRY
Synchrotron radiation: A new tool for biophysical spectroscopy in the visible and ultraviolet
[BNL-24917] N80-15225
Joint Soviet-American experiment on hypokinesia: Experimental results
[NASA-TM-75803] N80-15796
Biochemical indices of stress: Biochemical aspects of the stress response N80-15812
Psychostimulants N80-15817
BIODYNAMICS
Model task for the dynamics of an underwater two-legged walker
[NASA-TM-75697] N80-15822
BIOLOGICAL EFFECTS
Response of selected plant and insect species to simulated SRM exhaust mixtures and to exhaust components from SRM fuels N80-15657
Aerospace medicine and biology: A continuing bibliography, supplement 200
[NASA-SP-7011(200)] N80-15787
Biological effects of high-voltage electric fields, an update. Volume 2: Bibliography
[EPRI-EA-1123-VOL-2] N80-15801
BIOMASS
Research and evaluation of biomass resources/conversion/utilization systems [market/experimental analysis for development of a data base for a fuels from biomass model]
[COO-5022-5] N80-15576
BIOMASS ENERGY PRODUCTION
Mission analysis for the Federal fuels from biomass program. Volume 3: Feedstock availability
[SAN-0115-T1] N80-15276
Production of sugarcane and tropical grasses as a renewable energy source
[DOE/CS/7912-T1] N80-15277
Conversion of cellulosic and waste polymer material to gasoline
[COO-2982-38] N80-15291
Investigation of the viability and cost effectiveness of solid fuel gasifiers close coupled to internal combustion engines for 200 kWe power generation
[DOE/RL/90476-13] N80-15293
Economic analysis of small scale bioconversion units in New Mexico
[PB-301390/1] N80-15298
Research and evaluation of biomass resources/conversion/utilization systems [market/experimental analysis for development of a data base for a fuels from biomass model]
[COO-5022-5] N80-15576
BIOMEDICAL DATA
Study on the neuronal circuits implicated in postural tremor and hypokinesia
[NASA-TM-76004] N80-15783
BIONICS
Electromagnetic fields in biological media. Part 2: The SCAT program, multilayered sphere, theory and applications
[PB-300904/0] N80-15804
BIOSPHERE
US Geological Survey sources of photographs and images of biosphere reserves taken from *Spacecraft and Aircraft Aleutian Islands* National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain
[PB-297931/8] N80-15547
BLAST LOADS
Fleet hardness variation — to determine aircraft survivability due to blast loads
[AD-A074849] N80-15029
BLOOD
Activity of cholinesterases of blood and heart in rats of different sex and age during muscular loads and hypokinesia
[NASA-TM-75951] N80-15781
BLUNT BODIES
A supersonic, three-dimensional code for flow over blunt bodies: User's manual
[NASA-CR-3223] N80-15049
BODIES OF REVOLUTION
Numerical prediction of flows over and in the near wake behind axisymmetric, self-propelled bodies
[AD-A074971] N80-15371
Linear and nonlinear symmetrically loaded shells of revolution approximated with the finite element method
[LA-7539-MS] N80-15439
BODY FLUIDS
Changes of some blood indices and myocardial electrolyte content during hypokinesia
[NASA-TM-75954] N80-15790
BODY TEMPERATURE
Tolerance to shift work: A chronologic approach N80-15815
BODY-WING AND TAIL CONFIGURATIONS
On the effect of wing wake on tail characteristics N80-15174
BODY-WING CONFIGURATIONS
Studies of non-linear aerodynamic characteristics of flared slender bodies at high angles of attack
[TAE-349] N80-15032
BOEING 747 AIRCRAFT
Simultaneous cabin and ambient ozone measurements on two Boeing 747 airplanes, volume 1
[NASA-TM-79166] N80-15059
BOILERS
Characterization of operating conditions for gas/water heat recovery steam generators
[ORNL/TM-6622] N80-15620
BOILING
Two-phase vapour-liquid flow with phase change, review
[PB-299905] N80-15379
BORON
Investigation of elongation and its relationship to residual stresses in boron filaments
[AD-A074440] N80-15210
Energy absorption mechanisms during crack propagation in metal matrix composites
[NASA-CR-162574] N80-15232
BOUNDARY LAYER COMBUSTION
Experimental study of combustion in a turbulent boundary layer
[LBL-8946] N80-15218
BOUNDARY LAYER CONTROL
Control of forebody three-dimensional flow separations N80-15164
BOUNDARY LAYER EQUATIONS
The dynamics of material layers
[AD-A073728] N80-15740
BOUNDARY LAYER FLOW
The aerodynamic forces on airship hulls
[NACA-184] N80-15039
BOUNDARY LAYER SEPARATION
Fundamental studies of subsonic and transonic flow separation. *Part 3: Third phase summary report*
[AD-A074684] N80-15057
BOUNDARY LAYER TRANSITION
Applications of modern hydrodynamics to aeronautics. *Part 1: Fundamental concepts and the most important theorems.* Part 2: Applications
[NACA-116] N80-15034
The mechanism of fluid resistance N80-15035
Separation jump and sudden stall over an ellipsoidal wind at incidence — wing flow method tests for investigating laminar boundary layer, boundary layer transition, and separated flow
[AD-A074260] N80-15054
Development of an alternative to the E9 procedure for predicting boundary-layer transition
[AD-A074077] N80-15369
BOUNDARY LAYERS
Analysis and interpretation of tidal currents in the coastal boundary layer — Middle Atlantic Bight
[PB-299428/5] N80-15775
BOUNDARY VALUE PROBLEMS
Analytical solutions for open nonshallow spherical shell vibrations
[AD-A074269] N80-15434
Inelastic analysis of transverse deflection of plates by the boundary element method
[COO-2733-24] N80-15438
Methods for numerical conformal mapping
[LA-7836-MS] N80-15857
Comparison of boundary element and finite element methods in two-dimensional inelastic analysis
[COO-2733-22] N80-15864
BRANCHING [PHYSICS]
Bifurcation and stability in Yang-Mills theory with sources
[COO-3069-655] N80-15971
BRAZING
Metallographic quality control of welding and brazing
[CONF-790730-1] N80-15425
BREEDER REACTORS
Compatibility of structural materials with fusion reactor coolant and breeder fluids
[CONF-790125-77] N80-15906
BRIGHTNESS
Analysis of scanner data for crop inventories — North Dakota
[E80-10040] N80-15534
BRILLOUIN EFFECT
Observation of stimulated Brillouin scattering in a microwave plasma interaction experiment
[PPG-422] N80-15935
BRITTLE MATERIALS
Hugoniot elastic limits and compression parameters for brittle materials
[UCRL-83020] N80-15437
BUCKLING
Mitigating effects in the plastic failure of shells subjected to axially dependent dynamic pressure loadings
[COO-4122-27] N80-15443
BUILDINGS
Design of residential buildings utilizing natural thermal storage
[DOE/TIC-10143] N80-15302
BUTANES
Isobutane: Provisional thermodynamic functions from 114 to 700 K at pressures to 700 bar
[PB-299361/8] N80-15295

C

C BAND
Comparison of C-band radar and Doppler geoceiver accuracies in orbit determination
[AD-A073877] N80-15103
C-15 AIRCRAFT
Quiet powered-lift propulsion
[NASA-CP-2077] N80-15127
C-135 AIRCRAFT
The effects of motion and g-seat cues on pilot simulator performance of three piloting tasks
[NASA-TP-1601] N80-15069
CABIN ATMOSPHERES
Atmosphere — physiological basis for spacecraft pressure tolerance limits N80-15789
Contaminants — physiological effects of spacecraft contaminants N80-15790
CADMIUM
Low temperature electron irradiation and annealing of pure cadmium
[COO-1198-1274] N80-15246
CALCIUM METABOLISM
Mechanism of disorder of plastic processes in tissue during prolonged hypokinesia
[NASA-TM-75955] N80-15799
CALENDARS
Growth stage estimation — crop calendars N80-15458
CALIBRATING
Global calibration of terrestrial reference cells and errors involved in using different irradiance monitoring techniques
[NASA-TM-81393] N80-15561
CALIFORNIA
Feasibility of compressed air energy storage as a peak shaving technique in California. Volume 1: Executive summary
[SAN-1331-T2] N80-15636
ARMA models for earthquake ground motions — California
[UCRL-15084] N80-15719
Meteorological effects of oil refinery operations in Los Angeles
[PB-300720/0] N80-15758
CANADA
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE N80-15482
LACIE area, yield, and production estimate characteristics: Canada N80-15486
Use of thermal infrared and colour infrared imagery to detect crop moisture stress — Alberta, Canada
[E80-10036] N80-15530
HCMM/soil moisture experiment — Alberta, Canada
[E80-10037] N80-15531
CANARD CONFIGURATIONS
Aerodynamic interaction on a close-coupled canard wing configuration N80-15175
CARBIDES
An investigation of the initiation stage of hot corrosion in Ni-base alloys
[NASA-CR-159718] N80-15233
Design of duplex low-carbon steels with carbide forming elements
[LBL-8628] N80-15244
CARBON
Comparison of diurnal fluctuations of dissolved inorganic carbon and algal productivity estimates in an oligotrophic and mesotrophic freshwater environment
[PB-301201/0] N80-15785
CARBON DIOXIDE LASERS
Overvoltage protection by point-plane spark gaps
[LA-UR-79-1655] N80-15345
Optically pumped laser action and energy transfer in polyatomic molecules
[AD-A074985] N80-15389
Mirror quality required by the Antares laser system
[LA-UR-79-2058] N80-15405
Tripling of CO2 laser radiation in DBr, DCl and Se
[COO-4253-7] N80-15406
CARBON FIBERS
Preparation of unidirectional fiber reinforced tantalum carbide composites
[LA-UR-79-951] N80-15211
CARBON STEELS
Design of duplex low-carbon steels with carbide forming elements
[LBL-8628] N80-15244

CARBONATES
Prediction of current distribution in a molten carbonate fuel cell
[CONF-781063-1] N80-15613
CARDIOVASCULAR SYSTEM
Joint Soviet-American experiment on hypokinesia: Experimental results
[NASA-TM-76013] N80-15796
CASCADE RANGE [CA-OR-WA]
Geothermal energy development from the Salton Trough to the High Cascades — Cerro Prieto, Lower California and Mt. Hood, Oregon
[LBL-8703] N80-15568
CATALYSIS
Studies of metal-semiconductor interfaces in catalysis and energy conversion
[COO-4946-1] N80-15221
Hydrogen and methane syntheses through radiation catalysis
[COO-4258-1] N80-15284
CATALYSTS
Investigation of the effects of the installation of an oxidation catalyst on a diesel powered vehicle
[PB-299928/2] N80-15699
CAVITY RESONATORS
Two-pole varactor-tuned helical resonator filters
[AD-A074476] N80-15332
Laser intracavity modulation and stabilization
[AD-A074879] N80-15395
CENTRAL PROCESSING UNITS
High speed function generation for research and project support
[AD-A073973] N80-15197
Considerations for design of future research and development interactive image analysis systems
N80-15478
Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks
N80-15479
CENTRIFUGAL PUMPS
Analytical models and experimental studies of centrifugal-pump performances in two-phase flow — light water reactor coolant pumps
[EPRI-NP-477] N80-15415
CERAMIC COATINGS
Plasma-sprayed dual density ceramic turbine seal system
[NASA-CR-159739] N80-15411
CERAMICS
Gold plating metallized alumina ceramics
[GEPP-TIS-380] N80-15254
Displacement characteristics of a glass-ceramic insulator in a vacuum tube envelope sealing process
[GEPP-TIS-445] N80-15269
CH-46 HELICOPTER
CH-46 composite rotor blade flight stress survey data. Volume 3: Plotted forward rotor blade chord, torsion and absolute loads
[AD-A075612] N80-15077
CHANNEL FLOW
Use of fluvial processes to minimize adverse effects of stream channelization
[PB-299934/0] N80-15552
CHARGE CARRIERS
Optically induced hot electron effects in semiconductors
[AD-A073920] N80-15952
Topographic examination of semiconductor systems
[AD-A075007] N80-15953
CHARGE TRANSFER
Diagnostic neutral beams for spectroscopic studies of impurities by charge-transfer reactions
[CONF-790585-2] N80-15687
CHARGED PARTICLES
Bilocal field theory and a model for meson spectroscopy, part 1. Trident production by high energy charged particles on nuclei, part 2
[IS-T-86] N80-15889
CHEMICAL COMPOSITION
The effects of substrate composition on thick film circuit reliability
[AD-A074907] N80-15333
CHEMICAL PROPERTIES
The physical and chemical characterization of ten military turbine engine lubricants
[AD-A074073] N80-15265
Handbook of lunar materials
[NASA-RP-1057] N80-16009
CHEMICAL REACTIONS
DYNSYL: A general-purpose dynamic simulator for chemical processes
[UCRL-52561] N80-15219
CHEMISORPTION
Moisture sorption and diffusion in Kevlar 49 aramid fiber
[AD-A074547] N80-15266
CHINESE PEOPLES REPUBLIC
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
CHLORINATION
Waste stabilization lagoon microorganism removal efficiency and effluent disinfection with chlorine
[PB-300631/9] N80-15786
CHLOROPHYLLS
Charge separation in synthetic photo-reaction centers
[CONF-781048-1] N80-15784
CHOLINESTERASE
Activity of cholinesterases of blood and heart in rats of different sex and age during muscular loads and hypokinesia
[NASA-TM-75951] N80-15781
CHROMIUM
Fatigue crack propagation in 21/4 Cr-1 Mo steel
[CONF-790902-41] N80-15250
CHROMIUM STEELS
Effects of air melting on Fe/0.3/3Cr/0.5Mo/2Mn and Fe/0.3C/3Cr/0.5Mo/2Ni structural alloy steels
[LBL-9103] N80-15243
CHROMOSPHERE
Lyman alpha initiated winds in late-type stars
[NASA-CR-162467] N80-16008
CHRONOLOGY
Circadian and circannual rhythms in healthy adults
N80-15807
CIRCADIAN RHYTHMS
Sleep, Wakefulness and Circadian Rhythm
[AGARD-LS-105] N80-15806
Circadian and circannual rhythms in healthy adults
N80-15807
Circadian rhythms of human performance and resistance: Operational aspects
N80-15808
Sleep stage organization: Neuro endocrine relations
N80-15809
Tolerance to shift work: A chronologic approach
N80-15815
Circadian rhythms in air operations
N80-15816
Management of irregular rest and activity
N80-15819
CIRCUIT BREAKERS
Assessment of research directions for high voltage direct current power systems — using a high voltage direct current circuit breaker
[COO-5014-9] N80-15348
CIRCUIT PROTECTION
Overvoltage protection by point-plane spark gaps
[LA-UR-79-1655] N80-15345
CIRCUIT RELIABILITY
The effects of substrate composition on thick film circuit reliability
[AD-A074907] N80-15333
CIRCULAR CYLINDERS
Pressure fluctuations on the surface of a cylinder in uniform flow
[NASA-CR-162468] N80-15362
CIRRUS CLOUDS
Cirrus particle distribution study, part 4
[AD-A074763] N80-15735
CITIES
Use of fluvial processes to minimize adverse effects of stream channelization
[PB-299934/0] N80-15552
Quantity and quality of urban runoff from three localities in the Denver metropolitan area, Colorado
[PB-299859/9] N80-15698
CIVIL AVIATION
Design study of a low cost civil aviation GPS receiver system
[NASA-CR-159176] N80-15062
CLASSIFICATIONS
Classification and mensuration of LACIE segments
N80-15455
The classification and mensuration subsystem — wheat
N80-15465
On evaluating clustering procedures for use in classification
N80-15494
Linear feature selection with applications
N80-15496
Analysis of scanner data for crop inventories — North Dakota
[E80-10040] N80-15534
CLEAN ENERGY
Economic impacts of energy conservation and renewable energy sources
[UCRL-15087] N80-15633
CLEAR AIR TURBULENCE
NASA technical advances in aircraft occupant safety — clear air turbulence detectors, fire resistant materials, and crashworthiness
[NASA-TM-80851] N80-15060
Clear air turbulence. A bibliography with abstracts
[NTIS/PS-79/0972/4] N80-15752
CLIMATE
OTEC physical and climatic environmental impacts
[CONF-790631-11] N80-15664
Stratospheric aerosol modification by supersonic transport operations with climate implications
[NASA-RP-1058] N80-15726
CLIMATOLOGY
Input data for solar systems
[DOE/TIC-10193] N80-15580
Investigation of models for large-scale meteorological prediction experiments
[NASA-CR-162572] N80-15728
CLOUD COVER
Influence of clouds on UV-B penetration to the earth's surface
[NASA-CR-160428] N80-15703
CLOUD PHYSICS
Cloud volume studies — study of rocket exhaust clouds through nephanalysis and cloud physics
N80-15650
In situ exhaust cloud measurements — particle size distribution and cloud physics of rocket exhaust clouds
N80-15651
Cirrus particle distribution study, part 4
[AD-A074763] N80-15735
Airborne studies of atmospheric aerosol in the High Plains and the structures of natural and artificially seeded clouds in eastern Montana
[PB-299026/5] N80-15770
CLOUD SEEDING
Changes in cloud base precipitation particle size-distributions as a response variable to seeding
[PB-299549/6] N80-15761
Application of a two-dimensional cloud model to cloud seeding experiments
[PB-298997/8] N80-15769
Airborne studies of atmospheric aerosol in the High Plains and the structures of natural and artificially seeded clouds in eastern Montana
[PB-299026/5] N80-15770
CLOUDS
Cloud volume studies — study of rocket exhaust clouds through nephanalysis and cloud physics
N80-15650
In situ exhaust cloud measurements — particle size distribution and cloud physics of rocket exhaust clouds
N80-15651
CLOUDS [METEOROLOGY]
Cloud Top Scanning radiometer [CTS]
[NASA-CR-159954] N80-15381
Application of a two-dimensional cloud model to cloud seeding experiments
[PB-298997/8] N80-15769
CLUMPS
On the clustering of multidimensional pictorial data
N80-15493
On evaluating clustering procedures for use in classification
N80-15494
CLASSY: An adaptive maximum likelihood clustering algorithm
N80-15495
An evaluation of procedure 1
N80-15502
CMOS
Dielectric strength of SiO2 in a CMOS transistor structure
[SAND-79-1715C] N80-15965
COAL
Coal sulfur measurements
[PB-299575/1] N80-15294
Three potential longwall mining methods for thick coal seams in the western United States
[PB-299568/6] N80-15544
Coal mine combustion products identification and analysis: Procedures and summary
[PB-299559/5] N80-15545
Evaluation of the environmental effects of western surface coal mining, volume 1
[PB-300375/3] N80-15681
Pilot scale evaluation of NOx combustion control for pulverized coal, phase 2
[PB-299325/1] N80-15687
Management of coal preparation fine wastes without disposal ponds
[PB-299100/8] N80-15691
COAL GASIFICATION
Sulfur fixation during coal gasification — desulfurizing to reduce air pollution
[PB-301104/6] N80-15296
COAL LIQUEFACTION
Low temperature reaction path for coal liquefaction
[SAND-79-0736C] N80-15288
Environmental assessment report: Solvent Refined Coal [SRC] systems
[PB-300383/7] N80-15676
COAL UTILIZATION
Conversion of coal-based methanol to ethylene and a gaseous fuel
[PB-301256/4] N80-15297
COASTAL CURRENTS
Analysis and interpretation of tidal currents in the coastal boundary layer — Middle Atlantic Bight
[PB-299428/3] N80-15775
Far-field matching for tidal calculations in near-shore regions
[PB-299016/6] N80-15777
COASTAL WATER
Review of water intake screening options for coastal water users with recommendations for Ocean Thermal Energy Conversion [OTEC] plants
[ANL/OTEC-BCM-005] N80-15572
Atmospheric structural variations that result in upwelling off Oregon
[PB-301240/8] N80-15768
Trace element geochemistry of the South Atlantic bight
[DOE/EV-00890-3] N80-15774
Surface circulation in the northwestern Gulf of Mexico as deduced from drift bottles
[PB-299078/6] N80-15776
COASTS
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] N80-15526

Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[ERO-10032] N80-15527
COEFFICIENT OF FRICTION
The mechanism of fluid resistance
N80-15035
Adhesion and friction of iron-base binary alloys in contact with silicon carbide in vacuum
[NASA-TP-1604] N80-15234
COHERENT ACOUSTIC RADIATION
A study of partial coherence for identifying interior noise sources and paths on general aviation aircraft
[NASA-TM-80197] N80-15874
COHERENT LIGHT
Statistics of optical radiation scattered from rough surfaces
[AD-A074351] N80-15917
COLD TOLERANCE
Thermal environment — physiological basis for temperature tolerance limits
N80-15791
COLD WORKING
Anomalies in X-ray residual stress measurements in cold-rolled steels
[AD-A074022] N80-15239
COLLISION AVOIDANCE
VTS processing display subsystem design — to prevent environmental damage in harbor areas
[AD-A074053] N80-15830
COLLISION PARAMETERS
Heavy ion collisions at relativistic energies
[LBL-9494] N80-15888
COLLISIONAL PLASMAS
Two-stream instability for a scattered beam propagating in a collisional plasma
[LA-UR-79-1487] N80-15945
COLLISIONLESS PLASMAS
Equilibrium and stability in strongly inhomogeneous plasmas
[LBL-8529] N80-15929
COLOR
Generation of uniform chromaticity scale imagery from LANDSAT data
N80-15507
COLORADO
Quantity and quality of urban runoff from three localities in the Denver metropolitan area, Colorado
[PB-299859/9] N80-15698
COLORIMETRY
Colorimetric consideration of transparencies for a typical LACIE scene
N80-15506
COMBUSTIBLE FLOW
Experimental study of combustion in a turbulent boundary layer
[LBL-8946] N80-15218
COMBUSTION
Test equipment for use in determining classifications of combustible dusts
[PB-300615/2] N80-15231
Chemical aspects of afterburner systems
[PB-298465/6] N80-15684
COMBUSTION CHAMBERS
Quiet Clean Short-haul Experimental Engine [QCSEE]. Double-annular clean combustor technology development report
[NASA-CR-159483] N80-15121
COMBUSTION CONTROL
Pilot scale evaluation of NOx combustion control for pulverized coal, phase 2
[PB-299325/1] N80-15687
COMBUSTION EFFICIENCY
Influence of geometric and kinematic factors on combustion performance
[TAE-350] N80-15214
COMBUSTION PHYSICS
Combustion noise
[NASA-CR-162571] N80-15215
COMBUSTION PRODUCTS
Quiet Clean Short-haul Experimental Engine [QCSEE] clean combustor test report
[NASA-CR-134916] N80-15104
Theory of deposition of condensible impurities on surfaces immersed in combustion gases
[NASA-CR-159716] N80-15130
Experimental studies of the formation/deposition of sodium sulfate in/from combustion gases — hot corrosion of gas turbine engine components
[NASA-CR-159753] N80-15131
Coal mine combustion products identification and analysis: Procedures and summary
[PB-299559/5] N80-15545
COMMERCE
Commercialization strategy report for recovery of natural gas from unconventional sources
[TID-28940-DRAFT] N80-15287
COMMERCIAL AIRCRAFT
Aircraft delays at major US airports can be reduced
[PB-299442/4] N80-15061
COMMUNICATION SATELLITES
Design of the digital control and test unit subsystems for a satellite signal analyzer
[AD-A073928] N80-15313
Satellite television in Indonesia
[PB-299524/9] N80-15328
COMMUNICATIONS TECHNOLOGY SATELLITE
CTS attenuation and cross polarization measurements at 11.7 GHz
[NASA-CR-159952] N80-15308
COMPACTING
Effect of infrared radiation on compaction of municipic wastewater sludges
[PB-298296/5] N80-15998
COMPOSITE MATERIALS
Composite structural materials
[NASA-CR-162578] N80-15076
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] composite nacelle subsystem test report — to verify strength of selected composite materials
[NASA-CR-135075] N80-15100
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] composite nacelle
[NASA-CR-135352] N80-15119
Analysis of a unidirectional composite containing broken fibers and matrix damage
[NASA-CR-159185] N80-15205
Dynamics of composite materials and elastic structural elements with variable dimensions
[AD-A074592] N80-15206
Steady-state point-source excitation of a laminated composite
[AD-A074336] N80-15207
Classical analyses of laminated bimodulus composite-material plates
[AD-A074125] N80-15208
Preparation of unidirectional fiber reinforced tantalum carbide composites
[LA-UR-79-951] N80-15211
Moisture sorption and diffusion in Kevlar 49 aramid fiber
[AD-A074547] N80-15266
Critical speeds and natural frequencies of rim-type composite-material flywheels
[SAND-78-7049] N80-15622
COMPOSITE STRUCTURES
Composite structural materials
[NASA-CR-162578] N80-15076
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine composite fan blade design report
[NASA-CR-135046] N80-15108
COMPRESSED AIR
Feasibility of compressed air energy storage as a peak shaving technique in California, Volume 2
[SAN-1331-T1] N80-15596
Feasibility of compressed air energy storage as a peak shaving technique in California. Volume 1: Executive summary
[SAN-1331-T2] N80-15636
COMPRESSION LOADS
Hugoniot elastic limits and compression parameters for brittle materials
[UCRL-83002] N80-15437
COMPRESSION TESTS
Evaluation of forgeability of steels by notch compression method
[RFP-TRANS-273] N80-15249
Evaluation of the vane shear test in Louisiana
[PB-298872/3] N80-15723
COMPUTATION
Fast numerical calculations of ion-atom collisions
[CONF-7905111-1] N80-15880
Obtaining numerical values for the elliptic emission functions used in calculating electron emission from surfaces
[GEPP-TIS-443] N80-15961
COMPUTER GRAPHICS
Modifying the GNATS mesh generation code to improve the modeling of branched structures
[K/CSD/TM-26] N80-15444
Concepts leading to the IMAGE-100 hybrid interactive system
N80-15466
USDA analyst review of the LACIE IMAGE-100 hybrid system test
N80-15467
Cartography: LACIE's spatial processor
N80-15474
Man-machine interfaces in LACIE/ERIPS
N80-15476
LACIE/ERIPS software system summary
N80-15477
Considerations for design of future research and development interactive image analysis systems
N80-15478
Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks
N80-15479
Feature extraction applied to agricultural crops as seen by LANDSAT
N80-15497
An evaluation of procedure 1
N80-15502
Image and numerical display aids for manual interpretation
N80-15508
Special session on vision
[LBL-9160] N80-15802
Interactive graphic techniques for conceptual engineering design
[AD-A073837] N80-15840
COMPUTER INFORMATION SECURITY
Distributed, secure design for a multi-microprocessor operating system
[AD-A073923] N80-15828
COMPUTER NETWORKS
Minicomputers, volume 2. A bibliography with abstracts
[NTIS/PS-79/0978/1] N80-15832
Study of message text formats: Bibliographic search queries — computer networks for libraries and information services
[ISSN-0160-9742] N80-15981
Preliminary design of a network virtual data base system
[AD-A074205] N80-15986
Information management problems relating to numeric data base services for DOE
[DOE/TIC-10144] N80-15989
COMPUTER PROGRAMMING
Techniques employed in the processing of particle size spectra and state parameter data obtained with the T-28 aircraft platform
[PB-299362/4] N80-15771
Rationale for the design of the ADA programming language: Volume 14, no. 6, part B
[AD-A073854] N80-15842
REBEL/BASIC: Language, a user's guide
[UCRL-52668] N80-15849
COMPUTER PROGRAMS
Computer program to prepare airfoil characteristic data for use in helicopter performance calculations
[NASA-TM-78627] N80-15031
Calculation of two-dimensional inlet flow fields in a supersonic free stream by an implicit marching code with nonorthogonal mesh generation: User's manual
[NASA-CR-3222] N80-15043
A supersonic, three-dimensional code for flow over blunt bodies: User's manual
[NASA-CR-3223] N80-15049
Data reduction software for LORAN-C flight test evaluation
[NASA-CR-162730] N80-15064
Isobutane: Provisional thermodynamic functions from 114 to 700 K at pressures to 700 bar
[PB-299361/6] N80-15295
Analysis and computer programs for eddy current coils concentric with multiple cylindrical conductors
[ORNL-5220] N80-15359
Computer program for generating input for analysis of impingement-cooled, axial-flow turbine blade
[NASA-TP-1603] N80-15361
Continued development of fluid dynamics models
[AD-A073846] N80-15367
User's guide for a system of computer programs to predict flows over and in the near wake behind axisymmetric, self-propelled bodies
[AD-A074972] N80-15372
The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports
N80-15469
Man-machine interfaces in LACIE/ERIPS
N80-15476
On the clustering of multidimensional pictorial data
N80-15493
CLASSY: An adaptive maximum likelihood clustering algorithm
N80-15495
Signature extension methods in crop area estimation
N80-15501
A programmed labeling approach to image interpretation
N80-15509
Fuel utilization in residences
[EPRI-EA-894] N80-15604
Analytical modeling of heat pump units as a design aid and for performance prediction
[UCRL-52618] N80-15610
One-dimensional steady-state stream water-quality model
[PB-300327/4] N80-15677
Global crustal response model — using a computer program to mathematically model the Earth tide and its dynamic response
[NASA-CR-159955] N80-15705
TWINDX: A planetary boundary layer model for the winds in extratropical and tropical ocean areas
[AD-A074337] N80-15732
Electromagnetic fields in biological media. Part 2: The SCAT program, multilayered sphere, theory and applications
[PB-300904/0] N80-15804
PRIME and PDQ sorts: Efficient minimal storage sorting algorithms
[AD-A073567] N80-15841
An assessment of software quality assurance — to strengthen ballistic missile defense systems command research
[AD-A074213] N80-15843
QINTEG: A program for computing Gaussian quadrature coefficients
[AD-A073974] N80-15845
Additional software developments for the HP-21 MX
[AD-A074068] N80-15846
MIE scattering calculations, advances in technique and fast, vector-shaped computer codes
[PB-301388/5] N80-15923

SCRAP: Theory and modeling considerations
[ANL/CT-79-49] N80-15997
COMPUTER STORAGE DEVICES
On-board multispectral classification study. Volume 2: Supplementary tasks — adaptive control
[NASA-CR-159178] N80-15539
Data base management system configuration specification — computer storage devices
[NASA-CR-161351] N80-15825
Advanced electronic technology
[AD-A074083] N80-15950
COMPUTER SYSTEMS DESIGN
Considerations for design of future research and development interactive image analysis systems
N80-15478
A look at computer system selection criteria
N80-15480
Design and verification of reliable software
[AD-A074224] N80-15839
Software development system for small dedicated and front-end microcomputer [LSI-11] applications
[CONF-7811112-1] N80-15848
COMPUTER SYSTEMS PROGRAMS
Care 3, Phase 1, volume 1
[NASA-CR-159122] N80-15423
Care 3, phase 1, volume 2
[NASA-CR-159123] N80-15424
Interactive Environmental Impact Computer System [EICS] user manual
[AD-A074890] N80-15662
COMPUTER TECHNIQUES
An extension of engine weight estimation techniques to compute engine production cost
[AD-A074454] N80-15135
Limited vocabulary continuous word recognition
[AD-A074206] N80-15309
Aspects of computer control from the human engineering standpoint
[SLAC-PUB-2307] N80-15831
COMPUTERIZED DESIGN
Composite structural materials
[NASA-CR-162578] N80-15076
Analytical modeling of heat pump units as a design aid and for performance prediction
[UCRL-52618] N80-15610
Interactive graphic techniques for conceptual engineering design
[AD-A073857] N80-15840
A structural model for database systems
[AD-A074077] N80-15985
COMPUTERIZED SIMULATION
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine simulation report
[NASA-CR-134914] N80-15091
Computer simulation of engine systems
[NASA-TM-79290] N80-15132
DYNSYL: A general-purpose dynamic simulator for chemical processes
[UCRL-52561] N80-15219
Numerical simulation of supersonic inlets using a three-dimensional viscous flow analysis
[NASA-TM-81411] N80-15365
User's manual for computer code SOLTES-1 [Simulator Of Large Thermal Energy Systems]
[SAND-78-1315-REV] N80-15575
District space heating potential of low temperature hydrothermal geothermal resources in the southwestern United States — using computerized simulation
[NMEI-10-1] N80-15582
Wharton annual energy model: Development and simulation results
[EPRI-EA-1115] N80-15606
Acid rain: Mesoscale model
N80-15655
Birkeland currents and ring currents in the computer simulation of the substorm of 19 September 1976
[AD-A073852] N80-15712
Temporal and spatial power spectrum studies of numerical simulations of type 2 gradient drift irregularities in the equatorial electrojet
[AD-A073467] N80-15716
Investigation of adaptive control for recoil mechanisms
[AD-A074024] N80-15851
Geologic factors in nuclear waste disposal — computer simulation of radioactive waste transport from underground storage
[UCRL-52522] N80-15896
Physical conditions in reversed field pinches and theta pinches as inferred from simulations
[LA-UR-79-2368] N80-15937
COMPUTERS
Computer science and technology: Computer Performance Evaluation Users Group [CPEUG], 15th — conference
[PB-300468/6] N80-15833
Decision making and problem solving with computer assistance
[NASA-TM-76008] N80-15973
CONCENTRATION [COMPOSITION]
Effect of nitrogen concentration on temperature dependent mechanical properties of vanadium
[IS-M-195] N80-15248
Principles, calibration and process experience for a new laser aerosol detector system
[BNL-25018] N80-15403
Topographic examination of semiconductor systems
[AD-A075007] N80-15953
CONCENTRATORS
Status of the US Department of Energy photovoltaic concentrator development project
[SAND-78-2187C] N80-15578
CONCRETES
Evaluation of feasibility of prestressed concrete for use in wind turbine blades
[NASA-CR-159725] N80-15953
Analysis of field test results for single-axis-tracking solar collector foundations
[SAND-79-7023] N80-15586
CONDENSING
Two-phase vapour-liquid flow with phase change, review
[PB-299905] N80-15379
CONDUCTIVE HEAT TRANSFER
FLUFLOW: An appended code for calculating heat transfer to a fluid
[SAND-78-8271] N80-15377
Phase change heat conduction in general orthogonal curvilinear coordinates
[AD-A074896] N80-15969
CONFERENCES
Quiet powered-lift propulsion
[NASA-CP-2077] N80-15127
Technical evaluation report on the 28th Guidance and Control Panel Symposium on Advances in Guidance and Control Systems Using Digital Techniques
[AGARD-AR-148] N80-15140
Low cost aircraft flutter clearance — conference
[AGARD-CP-278] N80-15141
Aerodynamic characteristics of controls — conferences
[AGARD-CP-262] N80-15149
Measurements and standards for recycled oil - 2
[PB-299951/4] N80-15275
Proceedings of the Hydride Storage Reservoir Symposium/Workshop
[BNL-26523] N80-15286
Pavement evaluation and overlay design: A symposium and related papers
[PB-299896/1] N80-15305
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
Conference on performance monitoring techniques for evaluation of solar heating and cooling systems
[CONF-780432] N80-15599
All-union scientific and technical conference on use of the earth's heat for the production of electric power - summary of reports
[CONF-751270-SUMM] N80-15615
Proceedings of Shuttle Environmental Effects Program Review — conferences
[NASA-CP-2110] N80-15649
American-Soviet Symposium on Chemical Pollution of the Marine Environment, 1st
[PB-298343/5] N80-15683
Chemical Kinetic Data Needs for Modeling the Lower Troposphere
[PB-299439/0] N80-15722
SESAME (Severe Environmental Storms And Mesocale Experiment), 1979 plans for operations and data archival — conference
[PB-299878/9] N80-15756
Computer science and technology: Computer Performance Evaluation Users Group [CPEUG], 15th — conference
[PB-300468/6] N80-15833
Progress in wastewater disinfection technology — conference
[PB-299338/4] N80-16001
CONFORMAL MAPPING
Methods for numerical conformal mapping
[LA-7836-MS] N80-15857
CONGRESSIONAL REPORTS
International space activities, 1979
[GPO-53-451] N80-15184
The cost of clean air and water report to Congress
[PB-300446/2] N80-15693
Report to Congress on the economic impact of energy actions as required by public law 93-275, section 18-d
[DOE/PE-0007] N80-15993
CONSTANTS
Determination of optical constants for powdered materials in the 10 micron infrared region
[AD-A074465] N80-15918
CONSTRUCTION MATERIALS
Design of residential buildings utilizing natural thermal storage
[DOE/TIC-10143] N80-15302
Quality Assurance: Performance, sealers and materials variation — pavements and construction materials
[PB-299895/3] N80-15306
International activities: The fiscal year 1978 survey of international programs at NEL
[PB-300491/8] N80-16004
CONTINENTAL SHELVES
Federal leasing and outer continental shelf energy production goals
[DOE/RA-0037] N80-15640
CONTOURS
Concept development of automated image analysis. Automated contour recognition and classification in aerial photography by means of angles and curvature
[AD-A074439] N80-15540
CONTROL
Technical evaluation report on the 28th Guidance and Control Panel Symposium on Advances in Guidance and Control Systems Using Digital Techniques
[AGARD-AR-148] N80-15140
CONTROL CONFIGURED VEHICLES
Control considerations for CCV fighters at high angles of attack
N80-15160
Trajectory behaviour of a control configurated aircraft subjected to random disturbances
N80-15171
CONTROL SIMULATION
Quiet Clean Short-haul Experimental Engine [QCSEE] over-the-wing engine and control simulation results
[NASA-CR-135049] N80-15114
CONTROL STABILITY
An experimental study of the instability of thruster controlled systems
[RAU-EI-74-2-4] N80-15329
CONTROL SURFACES
Applications of modern hydrodyanmics to aeronautics. Part 1: Fundamental concepts and the most important theorems. Part 2: Applications
[NACA-116] N80-15034
Aerodynamic characteristics of controls — conferences
[AGARD-CP-262] N80-15149
Theoretical aerodynamic methods for active control devices
N80-15150
A survey of experimental data on the aerodynamics of controls, in the light of future needs
N80-15151
Correlation of F-15 flight and wind tunnel test control effectiveness
N80-15152
Wind tunnel measurements and analysis of some unusual control surfaces on two swept wing fighter configurations
N80-15155
Problems of unsteady aerodynamics raised by the use of control surfaces as active controls
N80-15167
On the effects of gaps on control surface characteristics
N80-15176
Aerodynamic study of missile control surfaces
N80-15177
CONTROLLED FUSION
Development of imploding liner systems for the NRL LINUS program
[AD-A075005] N80-15926
CONTROLLERS
Control systems design for large flexible space structures
[NASA-CR-162582] N80-15201
CONVECTIVE HEAT TRANSFER
FLUFLOW: An appended code for calculating heat transfer to a fluid
[SAND-78-8271] N80-15377
Phase change heat conduction in general orthogonal curvilinear coordinates
[AD-A074896] N80-15969
CONVERGENCE
Equivalence between resilvent consistency and convergence for nonlinear quasi-contractive algorithms
[ANL-79-53] N80-15863
COOLANTS
Compatibility of structural materials with fusion reactor coolant and breeder fluids
[CONF-790125-77] N80-15906
COOLING
Forced two phase helium cooling of large superconducting magnets
[LBL-9701] N80-15373
Crystallization, flow and thermal histories of lunar and terrestrial compositions
[NASA-CR-162445] N80-16013
COOLING SYSTEMS
Analytical models and experimental studies of centrifugal-pump performances in two-phase flow — light water reactor coolant pumps
[EPRI-NP-677] N80-15415
COORDINATES
Modifying the GNATS mesh generation code to improve the modeling of branched structures
[K/CSD/TM-26] N80-15444
Phase change heat conduction in general orthogonal curvilinear coordinates
[AD-A074896] N80-15969
CORE FLOW
Quiet Clean Short-haul Experimental Engine [QCSEE]. Aerodynamic and aeromechanical performance of a 50.8 cm [20 inch] diameter 1.34 PR variable pitch fan with core flow
[NASA-CR-135017] N80-15087
CORONAS
Lyman alpha initiated winds in late-type stars
[NASA-CR-162467] N80-16008
CORROSION
Corrosion of several alloys in superheated steam at 482 and 538 deg centigrade
[ORNL/TM-6465] N80-15252
The application of image processing to the detection of corrosion by radiography
[ARL/MAT-REPT-109] N80-15421

Crack tip plasticity associated with corrosion assisted fatigue
[AD-A073835] N80-15435

CORROSION RESISTANCE
Effect of sodium, potassium, magnesium, calcium, and chlorine on the high temperature corrosion of IN-100, U-700, IN-792, and Mar M-509 — coal-derived liquid fuel combustion in turbines
[NASA-TM-79309] N80-15235
Corrosion protection of solar-collector heat exchangers with electrochemically deposited films
[COO-4297-1] N80-15569

CORROSION TEST LOOPS
Corrosion of several alloys in superheated steam at 482 and 538 deg centigrade
[ORNL/TM-6465] N80-15252

COST ANALYSIS
LNG industry: An overview of projects and costs
[CONF-7811115-2] N80-15270
Resource modeling: A reality for program cost analysis
N80-15524
Documentation of the analysis of the benefits and costs of aeronautical research and technology models, volume 1
[NASA-CR-152278] N80-15865
Documentation of the Analyses of the Benefits and Costs of Aeronautical Research and Technology models [ABC-ART]. Volume 2: Appendices
[NASA-CR-152279] N80-15866

COST EFFECTIVENESS
Economic evaluation: Concepts, selected studies, system costs, and a proposed program
N80-15490
Value of crops: Quantity, quality and cost price — algae as a nutritional supplement
[NASA-TM-75925] N80-15537
Application analysis of solar total energy systems to the residential sector. Volume 4: Market penetration
[ALO-3787-4] N80-15597
A methodology for evaluating the effectiveness of transportation improvements for the elderly and handicapped
[PB-300440/5] N80-16007

COST ESTIMATES
An extension of engine weight estimation techniques to compute engine production cost
[AD-A074454] N80-15135
The cost of clean air and water report to Congress
[PB-300446/2] N80-15693

COSTS
An extension of engine weight estimation techniques to compute engine production cost
[AD-A074454] N80-15135

COUPLING
Energy coupling in the plasma focus
[UCRL-81907] N80-15928

COVARIANCE
Integrability conditions for the existence of a Lagrangian in Newtonian mechanics and field theory — Pauli's exclusion principle
[COO-4742-1] N80-15972

CRACK PROPAGATION
Model 540 rotor blade crack propagation investigation
[AD-A074734] N80-15081
Energy absorption mechanisms during crack propagation in metal matrix composites
[NASA-CR-162574] N80-15232
Fatigue crack propagation in 21/4 Cr-1 Mo steel
[CONF-790802-41] N80-15250
Crack tip plasticity associated with corrosion assisted fatigue
[AD-A073835] N80-15435

CRASH LANDING
Soil analyses and evaluations at the impact dynamics research facility for two full-scale aircraft crash tests
[NASA-CR-159199] N80-15299

CRATERING
Soil analyses and evaluations at the impact dynamics research facility for two full-scale aircraft crash tests
[NASA-CR-159199] N80-15299

CREEP ANALYSIS
Finite element method for studying the transient nonlinear thermal creep of geological structures
[LA-7983-MS] N80-15718

CREEP PROPERTIES
Uniaxial creep, cyclic creep and relaxation of AISI type 304 stainless steel at room temperature: An experimental study
[AD-A074958] N80-15240
Titanium and titanium alloy creep. A bibliography with abstracts
[NTIS/PS-79/0984/9] N80-15260
Unified creep-plasticity model for structural metals at high temperature
[ORNL/TM-5969] N80-15440
More efficient creep ratcheting bounds — for cylindrical shells
[ORNL/SUB-7322/1] N80-15441

CRITICAL VELOCITY
Critical speeds and natural frequencies of rim-type composite-material flywheels
[SAND-78-7049] N80-15622

CROP GROWTH
Growth stage estimation — crop calendars
N80-15458
The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE
N80-15482
Accuracy and performance of LACIE crop development models
N80-15489
Value of crops: Quantity, quality and cost price — algae as a nutritional supplement
[NASA-TM-75925] N80-15537

CROP IDENTIFICATION
Manual interpretation of LANDSAT data
N80-15460
Methods for segment wheat area estimation
N80-15491
On evaluating clustering procedures for use in classification
N80-15494
Feature extraction applied to agricultural crops as seen by LANDSAT
N80-15497
The vegetative index number and crop identification
N80-15503
Manual LANDSAT data analysis for crop type identification
N80-15504
Design, implementation, and results of LACIE field research
N80-15519

CROP INVENTORIES
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
Sampling, aggregation, and variance estimation for area, yield, and production in LACIE
N80-15449
Econometric models for predicting confusion crop ratios
N80-15450
LACIE sampling design
N80-15451
LACIE large area acreage estimation — United States of America
N80-15453
Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts — wheat
N80-15454
Classification and measuration of LACIE segments
N80-15455
Development of LACIE CCEA-1 weather/wheat yield models — regression analysis
N80-15457
Accuracy assessment: The statistical approach to performance evaluation in LACIE — Great Plains corridor, United States
N80-15459
Operation of the yield estimation subsystem
N80-15468
The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports
N80-15469
LACIE area, yield, and production estimate characteristics: U.S. Great Plains
N80-15484
LACIE area, yield, and production estimate characteristics: U.S.S.R.
N80-15485
LACIE area, yield, and production estimate characteristics: Canada
N80-15486
Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world
N80-15488
Economic evaluation: Concepts, selected studies, system costs, and a proposed program
N80-15490
Estimating crop proportions from remotely sensed data
N80-15492
Signature extension methods in crop area estimation
N80-15501
An evaluation of procedure 1
N80-15502
LACIE analyst interpretation keys
N80-15505
A programmed labeling approach to image interpretation
N80-15509
Analysis of scanner data for crop inventories — North Dakota
[E80-10040] N80-15534

CROP VIGOR
Application of LANDSAT digital data for monitoring drought — South Dakota
N80-15483
Value of crops: Quantity, quality and cost price — algae as a nutritional supplement
[NASA-TM-75925] N80-15537

CROSS FLOW
Multiple jet impingement heat transfer characteristic: Experimental investigation of in-line and staggered arrays with crossflow
[NASA-CR-3217] N80-15360
An experimental study of the structure and acoustic field of a jet in a cross stream — Ames 7-ft by 10-ft wind tunnel tests
[NASA-CR-162464] N80-15871

CROSS POLARIZATION
CTS attenuation and cross polarization measurements at 11.7 GHz
[NASA-CR-159952] N80-15308

CRUDE OIL
International energy assessment
[DOE/EIA-0184/1] N80-15594
Meteorological effects of oil refinery operations in Los Angeles
[PB-300720/0] N80-15758

CRUISING FLIGHT
Exploratory studies of the cruise performance of upper surface blown configuration: Experimental program, high-speed force tests
[NASA-CR-159134] N80-15070
Exploratory studies of the cruise performance of upper surface blown configurations: Experimental program, high-speed pressure tests
[NASA-CR-159135] N80-15071
Exploratory studies of the cruise performance of upper surface blown configurations: Program analysis and conclusions
[NASA-CR-159136] N80-15072

CRYOGENIC EQUIPMENT
Acoustic microscopy at cryogenic temperatures
[AD-A074502] N80-15919

CRYOGENIC MAGNETS
Nitrogen-strengthened austenitic stainless steel for cryogenic magnet structures
[CONF-790815-13] N80-15258

CRYOGENIC ROCKET PROPELLANTS
Advanced oxygen-hydrocarbon rocket engine study
[NASA-CR-161350] N80-15203

CRYOGENICS
Cryogenic hydrogen data pertinent to magnetic fusion energy
[UCRL-52628] N80-15292
International activities: The fiscal year 1978 survey of international programs at NEL
[PB-300491/8] N80-16004

CRYSTAL DEFECTS
Imaging of surfaces and defects of crystals — scanning transmission electron microscopy and diffraction patterns
[COO-2995-3] N80-15962
Electronic structure of defects in oxides
[ORO-4837-6] N80-15967

CRYSTAL GROWTH
Advanced methods for preparation and characterization of infrared detector materials — crystallization and phase diagrams of Hg sub 1-x Cd sub x Te
[NASA-CR-161352] N80-15948

CRYSTAL LATTICES
On 1/N expansions and the phased diagram of discrete lattice gauge theories with matter fields — Ising model
N80-15968

CRYSTAL STRUCTURE
The crystal structure and variable temperature Sn-119m Moessbauer study of trimethyltin glycinate, a one-dimensional, amino-bridged polymer
[AD-A074383] N80-15955

CRYSTAL SURFACES
Imaging of surfaces and defects of crystals — scanning transmission electron microscopy and diffraction patterns
[COO-2995-3] N80-15962

CRYSTALLINITY
Pulse and multiple pulse N.M.R. studies of crystallinity and molecular dynamics of solid state polymers
[IS-T-860] N80-15271

CRYSTALLIZATION
Crystallization, flow and thermal histories of lunar and terrestrial compositions
[NASA-CR-162445] N80-16013

CURRENT CONVERTERS [AC TO DC]
Analysis of the multiphase inductor-converter bridge — for the superconductive equilibrium field coils of the tokamak reactors and superconductive magnets used in particle accelerators
[CONF-790622-26] N80-15350

CURRENT DENSITY
Open-circuit voltage improvements in low resistivity solar cells
[NASA-TM-81388] N80-15555

CURRENT DISTRIBUTION
Prediction of current distribution in a molten carbonate fuel cell
[CONF-781063-1] N80-15613

CV-990 AIRCRAFT
Airborne measurements of solar and planetary near ultraviolet radiation during the NASA/ESA CV-900 spacelab simulation
[NASA-CR-162566] N80-16012

CYCLES
Alternate cycles applied to ocean thermal energy conversion
[SERI/TP-34-180] N80-15571

CYCLONES
A preliminary analysis of mesoscale effects of topography on tropical cyclone-associated surface winds
[AD-A074812] N80-15733

CYCLOTRON RESONANCE DEVICES
Analytic analysis of linear growth rates of gyrotron for TElns mode with zero-temperature beam electrons [AD-A074368] N80-15397
CYLINDRICAL BODIES
Analysis and computer programs for eddy current coils concentric with multiple cylindrical conductors [ORNL-5220] N80-15359
CYLINDRICAL SHELLS
More efficient creep ratcheting bounds — for cylindrical shells [ORNL/SUB-7322/1] N80-15441

D

DATA ACQUISITION
Analysis of low-speed helicopter flight test data [AD-A074141] N80-15079
Data acquisition and reduction for a high-resolution field ionization mass spectrometer [PB-299936/5] N80-15388
Acquisition and preprocessing of LANDSAT data N80-15461
Ancillary data acquisition for LACIE N80-15462
Woods Hole Oceanographic Institution Collection of Climatology and Air/Sea Interaction [CASI] data [AD-A075009] N80-15729
Software techniques for the acquisition of optical data from a minicomputer-based image-intensifier-vidicon system [AD-A074844] N80-15838
Microcomputer-controlled ultrasonic data acquisition system [ORNL/TM-6531] N80-15877
DATA BASES
LACIE status and tracking N80-15470
The LACIE data bases: Design considerations N80-15475
Data base design for a worldwide multicrop information system N80-15522
Data base management system configuration specification — computer storage devices [NASA-CR-161351] N80-15825
Performance and timeliness in a database [AD-A074552] N80-15826
Data model processing: An approach to standardization of database management systems [AD-A074601] N80-15827
Inverted file facility: User's guide [AD-A074081] N80-15982
Aerodynamic data base users guide [AD-A074448] N80-15983
A structural model for database systems [AD-A074077] N80-15985
Preliminary design of a network virtual data base system [AD-A074205] N80-15986
Induction over large data bases [AD-A074075] N80-15987
Information management problems relating to numeric data base services for DOE [DOE/TIC-10144] N80-15989
DATA CONVERSION ROUTINES
The application test system: Experiences to date and future plans N80-15525
DATA LINKS
HF modem evaluations for the Advanced Narrowband Digital Voice Terminal [ANDVT] [AD-A073674] N80-15323
DATA MANAGEMENT
LACIE status and tracking N80-15470
The application test system: Experiences to date and future plans N80-15525
SESAME [Severe Environmental Storms And Mesoscale Experiment], 1979 plans for operations and data archival — conference [PB-299878/9] N80-15756
Data base management system configuration specification — computer storage devices [NASA-CR-161351] N80-15825
Performance and timeliness in a database [AD-A074552] N80-15826
Data model processing: An approach to standardization of database management systems [AD-A074601] N80-15827
Analysis to determine functional and systems requirements for an on-line Structure and Composition System [SACS]. Report of task E: Analysis of current and developing systems which interface with LOGSACS and PERSACS to determine to what extent they do or do not support the data requirements of an on-line SACS [AD-A074638] N80-15868
Development of a quality assurance methodology for the technical information generation subsystem of NTIPS [AD-A074299] N80-15984
DATA PROCESSING
LACIE data-handling techniques N80-15463
The classification and mensuration subsystem — wheat N80-15465
Accuracy assessment system and operation N80-15472
Cartography: LACIE's spatial processor N80-15474
Summer fellowship in scientific computing [PB-301297/8] N80-15724
Techniques employed in the processing of particle size spectra and state parameter data obtained with the T-28 aircraft platform [PB-299362/4] N80-15771
Computer science and technology: Computer Performance Evaluation Users Group [CPEUG], 15th — conference [PB-300468/6] N80-15833
PRIME and FDQ sorts: Efficient minimal storage sorting algorithms [AD-A073567] N80-15841
DATA PROCESSING EQUIPMENT
Cost and performance characteristics of data system configurations for processing remotely sensed data N80-15481
Analysis to determine functional and systems requirements for an on-line Structure and Composition System [SACS]. Report of task E: Analysis of current and developing systems which interface with LOGSACS and PERSACS to determine to what extent they do or do not support the data requirements of an on-line SACS [AD-A074638] N80-15868
DATA PROCESSING TERMINALS
Man-machine interfaces in LACIE/ERIPS N80-15476
LACIE/ERIPS software system summary N80-15477
DATA RECORDERS
Application of the SIRS concept to Navy helicopters — systems analysis of flight data recorders of flight conditions of helicopters for structural analysis [AD-A074801] N80-15030
DATA REDUCTION
Data reduction software for LORAN-C flight test evaluation [NASA-CR-162730] N80-15064
Data acquisition and reduction for a high-resolution field ionization mass spectrometer [PB-299936/5] N80-15388
Manual interpretation of LANDSAT data N80-15460
Manual LANDSAT data analysis for crop type identification N80-15504
DATA RETRIEVAL
Study of message text formats: Bibliographic search queries — computer networks for libraries and information services [ISSN-0160-9742] N80-15981
DATA SAMPLING
Sampling, aggregation, and variance estimation for area, yield, and production in LACIE N80-15449
LACIE area sampling frame and sample selection N80-15452
New developments in sampling and aggregation for remotely sensed surveys N80-15515
Natural sampling strategy N80-15516
Multiyear estimates for the LACIE sampling plans N80-15517
Weighted aggregation N80-15518
DATA STORAGE
The acquisition, storage, and dissemination of LANDSAT and other LACIE support data N80-15464
The LACIE data bases: Design considerations N80-15475
Aerodynamic data base users guide [AD-A074448] N80-15983
Common file system reference manual, PIM-5 [LA-5525-M-VOL-5] N80-15988
DATA SYSTEMS
LACIE data-handling techniques N80-15463
The acquisition, storage, and dissemination of LANDSAT and other LACIE support data N80-15464
Operation of the yield estimation subsystem N80-15468
The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports N80-15469
Cost and performance characteristics of data system configurations for processing remotely sensed data N80-15481
DEACTIVATION
Radiation chemistry of hydrocarbon and alkyl halide systems — deactivation of excited atomic iodine [ORO-3106-71] N80-15222
DECISION MAKING
A look at computer system selection criteria N80-15480
Decision making and problem solving with computer assistance [NASA-TM-78008] N80-15973
Institutional barriers to wastewater reuse [PB-299027/3] N80-16002
Improving the scientific and technical information available to the Environmental Protection Agency in its decision making process [PB-300580/8] N80-16003
DECISION THEORY
Linear multiple objective problems with interval coefficients [AD-A073967] N80-15975
DEFORMATION
HONDO II: A finite element computer program for the large deformation dynamic response of axisymmetric solids [SAND-78-0422] N80-15442
Deformed shapes of hadrons [COO-3069-T1] N80-15882
DEICING
Aircraft anti-icing/de-icing [AD-A074128] N80-15078
DELAWARE
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] N80-15526
DELAY
Aircraft delays at major US airports can be reduced [PB-299442/4] N80-15061
DEMAND [ECONOMICS]
Minerals in the US economy: Ten-year supply-demand profiles for nonfuel mineral commodities [1968-77] [PB-299536/3] N80-15548
The 1985, 1990 and 1995 midterm energy market model results under three scenarios of Fuel Use Act regulations [DOE/EIA-0182/2] N80-15592
Energy supply and demand in the short term: 1979 and 1980 [DOE/EIA-0184/4] N80-15593
DENSITOMETERS
Performance evaluation of a drag-disc turbine transducer and three-beam gamma densitometer under transient two-phase flow conditions [CONF-790423-15] N80-15384
DENTISTRY
Apparent viscosities of setting elastomers — dental materials [AD-A074843] N80-15267
DEPOSITION
Experimental studies of the formation/deposition of sodium sulfate in/from combustion gases — hot corrosion of gas turbine engine components [NASA-CR-159753] N80-15131
DESALINIZATION
Use of geothermal energy for desalination in New Mexico: A feasibility study [PB-299271/7] N80-15645
DESIGN ANALYSIS
Design study for ATA vacuum system aperture [UCRL-15050] N80-15182
Cloud Top Scanning radiometer [CTS] [NASA-CR-159954] N80-15381
Design and performance of silicon solar cells under concentrated sunlight [SAND-79-1165C] N80-15577
Evaluation of the evacuated solar annular receivers used at the Midtemperature Solar Systems Test Facility [MSSTF] [SAND-78-0983] N80-15585
Sandia composite-rim flywheel development [SAND-78-1865C] N80-15624
DESULFURIZING
Sulfur fixation during coal gasification — desulfurizing to reduce air pollution [PB-301104/6] N80-15296
EPA utility FGD [Flue Gas Desulfurization] survey: December 1978 - January 1979 — electric power plants [PB-299399/6] N80-15682
DETONATION
The investigation of man-made modifications of the ionosphere — effects of detonations and rocket exhaust [NASA-CR-162579] N80-15707
DEUTERIUM COMPOUNDS
Tripling of CO2 laser radiation in DBr, DCl and Se [COO-4253-7] N80-15406
DICHROISM
Measurement of polarized light scattering via the Mueller matrix [AD-A074431] N80-15922
DIELECTRIC PROPERTIES
Dielectric strength of SiO2 in a CMOS transistor structure [SAND-79-1715C] N80-15965
DIELECTRICS
Partial discharge performance of lapped plastic insulation for superconducting power transmission cables and the dielectric strength of supercritical helium gas [BNL-24779] N80-15346

DIESEL ENGINES
Emissions characteristics of six high-speed diesel engines — for use in underground mines
[BETC/TPR-78/7] N80-15667
Investigation of the effects of the installation of an oxidation catalyst on a diesel powered vehicle
[PB-299928/7] N80-15699
DIFFERENTIAL EQUATIONS
A differential dynamic programming algorithm for the solution of the three-dimensional optimal missile avoidance
[TAE-351] N80-15835
SNEX: Semianalytic solution of the one-dimensional discrete ordinates [S/sub N] transport equations with diamond differenced angular fluxes
[LA-7879-MS] N80-15856
Regularity of solutions to an inhomogeneous differential equation in Banach space
[CONF-790810-1] N80-15862
DIFFRACTION PATTERNS
Imaging of surfaces and defects of crystals — scanning transmission electron microscopy and diffraction patterns
[COO-2995-1] N80-15962
DIFFUSION COEFFICIENT
Moisture sorption and diffusion in Kevlar 49 aramid fiber
[AD-A074547] N80-15266
DIGESTING
Fast production of methane by anaerobic digestion. Volume 2: Appendices
[COO-2900-17-VOL-2] N80-15283
DIGITAL COMMAND SYSTEMS
Roll control by digitally controlled segment spoilers
N80-15156
DIGITAL DATA
LACIE registration processing
N80-15456
Acquisition and preprocessing of LANDSAT data
N80-15461
Application of LANDSAT digital data for monitoring drought — South Dakota
N80-15483
DIGITAL FILTERS
Geometric design technique for two-dimensional analog and digital filters
[AD-A073963] N80-15334
An in-depth study of the sensitivity of wave digital filters
[AD-A073962] N80-15338
DIGITAL SIMULATION
High speed function generation for research and project support
[AD-A073973] N80-15197
DIGITAL SYSTEMS
Loran digital phase-locked loop and RF front-end system error analysis
[NASA-CR-162731] N80-15065
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine digital control system design report
[NASA-CR-134920] N80-15090
Quiet Clean Short-haul Experimental Engine [QCSEE] over-the-wing control system design report
[NASA-CR-135337] N80-15092
HF modem evaluations for the Advanced Narrowband Digital Voice Terminal [ANDVT]
[AD-A073674] N80-15323
DIGITAL TECHNIQUES
Technical evaluation report on the 28th Guidance and Control Panel Symposium on Advances in Guidance and Control Systems Using Digital Techniques
[AGARD-AR-148] N80-15140
DIPOLE ANTENNAS
Analysis of wire antennas mounted near or at the edge of a half-plane
[AD-A074450] N80-15310
DIRECT CURRENT
Assessment of research directions for high voltage direct current power systems — using a high voltage direct current circuit breaker
[COO-5014-9] N80-15348
DIRECT LIFT CONTROLS
In-flight measured characteristics of combined flap-spoiler direct lift controls
N80-15165
DIRECTIONAL SOLIDIFICATION [CRYSTALS]
Directional solidification at ultra-high thermal gradient
[NASA-CR-159797] N80-15300
DISEASES
Toxic polypeptides and uremia
[PB-300063/4] N80-15803
DISKS [SHAPES]
Stress-intensity factors and crack-opening displacements for round compact specimens — fracture toughness of metallic materials
[NASA-TM-80174] N80-15430
DISLOCATIONS [MATERIALS]
Analysis of a unidirectional composite containing broken fibers and matrix damage
[NASA-CR-159185] N80-15205
DISORDERS
A research agenda on science and technology for the handicapped
[PB-301220/0] N80-16005
DISPLAY DEVICES
Design study of a low cost civil aviation GPS receiver system
[NASA-CR-159176] N80-15062
Effects of varying visual display characteristics of the T-4G, a T-37 flight simulator
[AD-A071410] N80-15180
Concepts leading to the IMAGE-100 hybrid interactive system
N80-15486
Image and numerical display aids for manual interpretation
N80-15508
DISTRIBUTION FUNCTIONS
Estimating crop proportions from remotely sensed data
N80-15492
DISTRIBUTION MOMENTS
Angular momentum and the collective modes excited in deep-inelastic processes and in fission
[LBL-9173] N80-15904
DISTRICT OF COLUMBIA
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10091] N80-15526
DIURNAL VARIATIONS
A model of diurnal variability of the ocean-atmosphere system in the undisturbed trade wind regime
[AD-A073540] N80-15749
Northwest New Mexico boundary layer experiment
[LA-7525-MS] N80-15751
Comparison of diurnal fluctuations of dissolved inorganic carbon and algal productivity estimates in an oligotrophic and mesotrophic freshwater environment
[PB-301201/0] N80-15785
DOCUMENT STORAGE
The acquisition, storage, and dissemination of LANDSAT and other LACIE support data
N80-15464
DOCUMENTS
NASA publications
[NASA-TM-80852] N80-15980
DOMESTIC ENERGY
Commercialization strategy report for recovery of natural gas from unconventional sources
[TID-28949-DRAFT] N80-15287
Measurement of energy to heat houses: Initial study
[PB-299948/2] N80-15304
DOPED CRYSTALS
Electric characteristics of ion-implanted laser-annealed silicon
[CONF-780932-4] N80-15352
DOPPLER RADAR
Comparison of C-band radar and Doppler geoviver accuracies in orbit determination
[AD-A073877] N80-15193
An analysis of clear air planetary boundary layer wind synthesized from NSSL's dual Doppler-radar data
[PB-300865/3] N80-15755
DRAG DEVICES
Performance evaluation of a drag-disc turbine transducer and three-beam gamma densitometer under transient two-phase flow conditions
[CONF-790423-15] N80-15384
DRAG REDUCTION
The minimum induced drag of aerofoils
[NACA-121] N80-15038
Direct side force and drag control with the aid of pylon split flaps
N80-15163
DRAINAGE
Quantity and quality of urban runoff from three localities in the Denver metropolitan area, Colorado
[PB-299859/9] N80-15698
DROUGHT
Application of LANDSAT digital data for monitoring drought — South Dakota
N80-15483
DUCTED FANS
Acoustic analysis of aft noise reduction techniques measured on a subsonic tip speed 50.8 cm [twenty inch] diameter fan — quiet engine program
[NASA-CR-134891] N80-15102
DUST
Test equipment for use in determining classifications of combustible dusts
[PB-300615/2] N80-15231
DYE LASERS
Rocketborne laser backscatter experiment
[AD-A073853] N80-15398
Tunable lasers for waste management photochemistry applications
[LA-7113-MS] N80-15402
Pulsed dye laser OAS with a Helmholtz resonator cell
[CONF-790819] N80-15404
DYES
Estimating the gas and dye quantities for modified tracer technique measurement of stream reaeration coefficients
[PB-299015/8] N80-15690
DYNAMIC CHARACTERISTICS
Dynamic identification of light aircraft structures and their flutter certification
N80-15145
DYNAMIC CONTROL
Theoretical aerodynamic methods for active control devices
N80-15150
A survey of experimental data on the aerodynamics of controls, in the light of future needs
N80-15151
AFFDL experience in active control technology
N80-15159
Fin design with ACT in the presence of strakes
N80-15161
Control integration technology impact — as a basis for improving the combat effectiveness of all tactical aircraft
N80-15162
DYNAMIC LOADS
Mitigating effects in the plastic failure of shells subjected to axially dependent dynamic pressure loadings
[COO-4122-27] N80-15443
DYNAMIC PROGRAMMING
DYNSYL: A general-purpose dynamic simulator for chemical processes
[UCRL-52561] N80-15219
A differential dynamic programming algorithm for the solution of the three-dimensional optimal missile avoidance
[TAE-351] N80-15835
DYNAMIC RESPONSE
Dynamics of composite materials and elastic structural elements with variable dimensions
[AD-A074592] N80-15206
Response of nonlinear structural panels subjected to high intensity noise
[AD-A074986] N80-15432
HONDO II: A finite element computer program for the large deformation dynamic response of axisymmetric solids
[SAND-78-0422] N80-15442
Global crustal response model — using a computer program to mathematically model the Earth tide and its dynamic response
[NASA-CR-159955] N80-15705
An analytic method for strong motion studies in layered media
[PB-301116/0] N80-15725
Changes in cloud base precipitation particle size-distributions as a response variable to seeding
[PB-299549/4] N80-15761
SCRAP. Theory and modeling considerations
[ANL-CT-79-49] N80-15997
DYNAMIC STRUCTURAL ANALYSIS
Analyses and tests of the B-1 aircraft structural mode control system
[NASA-CR-144887] N80-15073

E

E-4A AIRCRAFT
Trajectory behaviour of a control configurated aircraft subjected to random disturbances
N80-15171
EARTH CORE
Physics of mantle and core minerals
[E80-10038] N80-15532
EARTH ORBITS
Analysis of GaAs and Si solar cell arrays for earth orbital and orbit transfer missions
[NASA-TM-81383] N80-15204
EARTH TIDES
Global crustal response model — using a computer program to mathematically model the Earth tide and its dynamic response
[NASA-CR-159955] N80-15705
EARTHQUAKES
ARMA models for earthquake ground motions — California
[UCRL-15084] N80-15719
An analytic method for strong motion studies in layered media
[PB-301116/0] N80-15725
ECHO SOUNDING
Atmospheric echo sounding. A bibliography with abstracts
[NTIS/PS-79/0989/8] N80-15721
ECOLOGY
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] N80-15526
Proceedings of Shuttle Environmental Effects Program Review — conferences
[NASA-CP-2110] N80-15649
Ecological baseline studies
N80-15658
ECONOMETRICS
Economic evaluation: Concepts, selected studies, system costs, and a proposed program
N80-15490
Energy demand in the developing countries
[DOE/EIA-0183/10] N80-15631
ECONOMIC ANALYSIS
Economic analysis of small scale bioconversion units in New Mexico
[PB-301390/1] N80-15298

Economical space power systems
[NASA-CR-159696] N80-15559
Solar enhanced oil recovery: An assessment of economic feasibility
[SAND-79-0787] N80-15641
ECONOMIC DEVELOPMENT
A program of management and technical assistance in the state of Washington — in support of economic growth
[PB-299276/6] N80-15977
ECONOMIC FACTORS
International energy assessment
[DOE/EIA-0184/1] N80-15594
Nuclear strategy of the Department of Energy
[DOE/ER-0025/D] N80-15605
ECONOMIC IMPACT
Wharton annual energy model: Development and simulation results
[EPRI-EA-1115] N80-15606
Economic impacts of energy conservation and renewable energy sources
[UCRL-15087] N80-15633
Socio-economic impact analysis of selected air pollution controls in the Houston-Galveston region
[PB-299635/3] N80-15679
Petrochemicals: Their economic significance in the domestic economy
[PB-299733/6] N80-15992
Report to Congress on the economic impact of energy actions as required by public law 93-275, section 18-d
[DOE/PE-0007] N80-15993
ECONOMICS
Econometric models for predicting confusion crop ratios N80-15450
ECOSYSTEMS
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[EAO-30031] N80-15526
Ecological baseline studies N80-15658
Atmospheric structural variations that result in upwelling off Oregon
[PB-301240/5] N80-15768
EDDY CURRENTS
Computation of transient 3-D eddy current in nonmagnetic conductor
[CONF-780939-1] N80-15356
Analysis and computer programs for eddy current coils concentric with multiple cylindrical conductors
[ORNL-5220] N80-15359
EDUCATION
The application test system: Experiences to date and future plans N80-15525
Development of the Rocky Mountain Energy and Environmental Technology Center: A preliminary analysis
[ORAU-158] N80-15670
Solar energy meteorological research and training site, region 5 — project planning for education course in solar radiation and meteorology
[DOE/ET/20172-1] N80-15750
EFFICIENCY
LACIE applications evaluation system efficiency report N80-15473
EFFLUENTS
Field and laboratory studies for the development of effluent standards for the steam electric power industry
[PB-299097/6] N80-15689
Biological screening of complex samples from industrial/energy processes
[PB-300459/5] N80-15805
EIGENVALUES
Analysis techniques for multivariate root loci — a tool in linear control systems
[NASA-CR-162570] N80-15853
EIGENVECTORS
Theory of drift-wave eigenmodes in toroidal plasmas
[PPPL-1562] N80-15936
ELASTIC PROPERTIES
Dynamics of composite materials and elastic structural elements with variable dimensions
[AD-A074592] N80-15206
Classical analyses of laminated bimodulus composite-material plates
[AD-A074125] N80-15208
Hugoniot elastic limits and compression parameters for brittle materials
[UCRL-83020] N80-15437
ELASTIC SCATTERING
On the multiple scattering of waves from obstacles with solid-fluid interfaces
[AD-A074057] N80-15433
Hydrogen scattering cross section, 1H[a,a]1H
[LA-7899-MS] N80-15958
ELASTIC SHELLS
Analytical solutions for open nonshallow spherical shell vibrations
[AD-A074269] N80-15434
ELASTIC WAVES
Method of optimal truncation: A new t-matrix approach to elastic wave scattering
[LA-UR-79-1956] N80-15324
On the multiple scattering of waves from obstacles with solid-fluid interfaces
[AD-A074057] N80-15433
ELASTOMERS
Apparent viscosities of setting elastomers — dental materials
[AD-A074843] N80-15267
Petrochemicals: Their economic significance in the domestic economy
[PB-299733/6] N80-15992
ELASTOPLASTICITY
Elastic-plastic analyses for seismic reserve capacity in power plant braced frames
[UCRL-52614] N80-15303
ELECTRETS
Ground-based measurements of DM-2 rocket exhaust effluents using fixed-flow samplers and electrets N80-15654
ELECTRIC BRIDGES
Analysis of the multiphase inductor-converter bridge — for the superconductive equilibrium field coils of the tokamak reactors and superconductive magnets used in particle accelerators
[CONF-790622-26] N80-15350
ELECTRIC CHARGE
Configuration effects on satellite charging response
[NASA-TM-81397] N80-15200
ELECTRIC CONDUCTORS
Computation of transient 3-D eddy current in nonmagnetic conductor
[CONF-780939-1] N80-15356
Analysis and computer programs for eddy current coils concentric with multiple cylindrical conductors
[ORNL-5220] N80-15359
ELECTRIC CONNECTORS
High current testing of lightning arrestor connectors
[SAND-74-0326] N80-15347
ELECTRIC ENERGY STORAGE
Feasibility of compressed air energy storage as a peak shaving technique in California. Volume 1: Executive summary
[SAN-1331-T2] N80-15636
ELECTRIC EQUIPMENT TESTS
High current testing of lightning arrestor connectors
[SAND-74-0326] N80-15347
ELECTRIC FIELDS
Biological effects of high-voltage electric fields, an update. Volume 2: Bibliography
[EPRI-EA-1123-VOL-2] N80-15801
ELECTRIC FILTERS
Two-pole varactor-tuned helical resonator filters
[AD-A074476] N80-15332
ELECTRIC GENERATORS
Investigation of the viability and cost effectiveness of solid fuel gasifiers close coupled to internal combustion engines for 200 kWe power generation
[DOE/RL/90476-13] N80-15293
Demonstration of a nitrogen based carburizing atmosphere: Energy consumption of the endothermic generator
[CONS/5058-T1] N80-15591
ELECTRIC MOTOR VEHICLES
Lithium/iron sulfide batteries for electric vehicles
[CONF-781006-2] N80-15611
Energy storage system for automobile propulsion, 1978 study. 2: Detailed report
[UCRL-52553-VOL-2] N80-15995
New transportation systems and technology, 1979: Transportation research record 708
[PB-300747/3] N80-16000
ELECTRIC NETWORKS
Transient analysis of multiconductor transmission line networks: A comparison of experimental and numerical results
[AD-A074950] N80-15344
ELECTRIC POTENTIAL
Open-circuit voltage improvements in low resistivity solar cells
[NASA-TM-81388] N80-15555
ELECTRIC POWER PLANTS
Photovoltaic power system reliability considerations
[NASA-TM-79291] N80-15422
Department of Energy large solar central power systems semiannual review
[SAND-78-8511] N80-15601
Department of Energy large solar central power systems semiannual review
[SAND-79-8508] N80-15602
Feasibility of compressed air energy storage as a peak shaving technique in California. Volume 1: Executive summary
[SAN-1331-T2] N80-15636
Environmental development plan: Electric Energy Systems
[DOE/EDP-0038] N80-15669
EPA utility FGD [Flue Gas Desulfurization] survey: December 1978 - January 1979 — electric power plants
[PB-299399/6] N80-15682
Field and laboratory studies for the development of effluent standards for the steam electric power industry
[PB-299097/6] N80-15689
ELECTRIC POWER SUPPLIES
Feasibility of compressed air energy storage as a peak shaving technique in California. Volume 2
[SAN-1331-T1] N80-15596
ELECTRIC POWER TRANSMISSION
The effects of primary power transmission lines on the performance of LORAN-C receivers in experimental terrestrial applications
[PB-301367/9] N80-15066
Environmental development plan: Electric Energy Systems
[DOE/EDP-0038] N80-15669
Biological effects of high-voltage electric fields, an update. Volume 2: Bibliography
[EPRI-EA-1123-VOL-2] N80-15801
ELECTRIC PULSES
An experimental study of the instability of thruster controlled systems
[RAU-EI-74-2-6] N80-15329
ELECTRIC STIMULI
Evoked potentials in immobilized cats to a combination of clicks with painful electrocutaneous stimuli
[NASA-TM-75941] N80-15780
ELECTRIC SWITCHES
Bulletin of the Division of Mechanical Engineering and the National Aeronautical Establishment — design of a gas pipeline station control system and a railway switch car
[AD-A074485] N80-16022
ELECTRIC WIRE
Analysis of wire antennas mounted near or at the edge of a half-plane
[AD-A074450] N80-15310
ELECTRICAL FAULTS
Sympathetic breakdown on gaps in air
[SAND-79-0598C] N80-15355
ELECTRICAL INSULATION
Study of electronic transport and breakdown in thin insulating films
[AD-A074457] N80-15342
Partial discharge performance of lapped plastic insulation for superconducting power transmission cables and the dielectric strength of supercritical helium gas
[BNL-24779] N80-15346
ELECTRICAL MEASUREMENT
Description of the MIT/Lincoln Laboratory photovoltaic systems test facility
[COO-4094-61] N80-15638
ELECTRICAL PROPERTIES
Modifications in optoelectronic behavior of plasma-deposited amorphous semiconductor alloys via impurity incorporation
[BNL-26646] N80-15255
Electrical activity in shock-loaded polymers
[SAND-79-0592C] N80-15270
Local electronic properties of dilute magnetic alloys
[SAN-0034-T4] N80-15966
ELECTRICAL RESISTANCE
Open-circuit voltage improvements in low resistivity solar cells
[NASA-TM-81388] N80-15555
ELECTRICAL RESISTIVITY
Test equipment for use in determining classifications of combustible dusts
[PB-300615/2] N80-15231
Analysis of wire antennas mounted near or at the edge of a half-plane
[AD-A074450] N80-15310
Activation volumes of some superionic conductors with the fluorite structure
[COO-1198-1264] N80-15349
Electric characteristics of ion-implanted laser-annealed silicon
[CONF-780932-4] N80-15352
ELECTRO-OPTICS
Phase matrix measurements for electromagnetic scattering by sphere aggregates
[AD-A074464] N80-15916
Electrical and optical properties of high purity p-type single crystals of GeFe2O4
[AD-A073996] N80-15949
ELECTROLYSIS
High temperature electrolysis — synthetic fuel production
[BNL-26331] N80-15227
ELECTROLYTIC CELLS
Development of Li-Al/FeS cells with LiCl-rich electrolyte
[CONF-7810135-2] N80-15614
ELECTROMAGNETIC ABSORPTION
Quantitative comparison of multiple-photon absorption in polyatomic molecules
[CONF-790690-3] N80-15892
ELECTROMAGNETIC FIELDS
Electromagnetic fields in biological media. Part 2: The SCAT program, multilayered sphere, theory and applications
[PB-300904/0] N80-15804
ELECTROMAGNETIC PULSES
Pulse and multiple pulse N.M.R. studies of crystallinity and molecular dynamics of solid state polymers
[IS-T-860] N80-15271

Pulser for vertically polarized dipole facility [VPD-2]
[AD-A074838] N80-15319
Electromagnetic pulse interaction notes: EMP 3-39
[AD-A074265] N80-15321
Transient analysis of multiconductor transmission line networks: A comparison of experimental and numerical results
[AD-A074950] N80-15344
ELECTROMAGNETIC RADIATION
Investigation of efficiency optimization in free electron lasers
[LA-UR-79-2179] N80-15400
ELECTROMAGNETIC SCATTERING
Phase matrix measurements for electromagnetic scattering by sphere aggregates
[AD-A074046] N80-15916
ELECTROMAGNETIC WAVE TRANSMISSION
Electromagnetic transmission through an annular aperture in an infinite conducting screen
[AD-A074831] N80-15320
Ray and wave optics of integrable and stochastic systems
[LBL-9465] N80-15921
ELECTRON BEAMS
Low pressure, high voltage discharges for the production of energetic electron beams
[AD-A074556] N80-15336
Characteristics of electron oscillation and amplification. 1: Power and frequency characteristics
[AD-A074761] N80-15337
Research on low temperature, directed energy processing of very large scale integrated structures
[AD-A074127] N80-15340
Analytic analysis of linear growth rates of gyrotron for TE1n mode with zero-temperature beam electrons
[AD-A074368] N80-15397
Pulsed power for fusion
[SAND-79-0933C] N80-15908
ELECTRON EMISSION
Obtaining numerical values for the elliptic emission functions used in calculating electron emission from surfaces
[GEPP-TIS-443] N80-15961
ELECTRON IMPACT
Electron impact ionization of multicharged ions
[ORNL/TM-7025] N80-15879
ELECTRON IRRADIATION
Effect of point defects on mechanical properties of metals
[COO-1367-97] N80-15245
Low temperature electron irradiation and annealing of pure cadmium
[COO-1098-1274] N80-15246
ELECTRON MICROSCOPY
Imaging of surfaces and defects of crystals — scanning transmission electron microscopy and diffraction patterns
[COO-2995-3] N80-15962
ELECTRON PARAMAGNETIC RESONANCE
Itinerant electron magnetism in 3D-transition metals
[CONF-790738-1] N80-15959
ELECTRON SCATTERING
Large momentum transfer electron scattering from few-nucleon systems
[SLAC-PUB-2373] N80-15890
Two-stream instability for a scattered beam propagating in a collisional plasma
[LA-UR-79-1607] N80-15945
Local electronic properties of dilute magnetic alloys
[SAN-0034-T4] N80-15946
ELECTRON SPECTROSCOPY
Time-resolved spectroscopic studies of surface reactions
[AD-A074952] N80-15216
ELECTRON STATES
Radiation chemistry of hydrocarbon and alkyl halide systems — deactivation of excited atomic iodine
[ORO-3106-71] N80-15222
ELECTRON TRANSITIONS
Investigation of plasma processes in electronic transition lasers
[AD-A074892] N80-15394
ELECTROPHOTOMETRY
Photoelectron spectra of trinuclear metal cluster complexes
[CONF-790658-7] N80-15247
ELECTROPLATING
Gold plating metallized alumina ceramics
[GEPP-TIS-380] N80-15254
ELECTROSTATIC PRECIPITATORS
In-stack plume opacity from electrostatic precipitator/scrubber system at Harrington Unit 1
[PB-299215/4] N80-15686
ELEVATORS [CONTROL SURFACES]
Some investigations concerning the effects of gaps and vortex generators on elevator efficiency and of landing flap sweep on aerodynamic characteristics
N80-15178
ELLIPSOIDS
Remarks on the pressure distribution over the surface of an ellipsoid, moving translationally through a perfect fluid
[NACA-TM-196] N80-15041
Flow and drag formulas for simple quadrics — pressure drag and flow equations for an ellipsoid in incompressible fluids
[NACA-253] N80-15043
Flow and force equations for a body revolving in a fluid
[NACA-323] N80-15044
Separation jump and sudden stall over an ellipsoidal wind at incidence — wing flow method tests for investigating laminar boundary layer, boundary layer transition, and separated flow
[AD-A074260] N80-15054
General least-squares fitting procedures to minimize the volume of a hyperellipsoid — linear accelerators
[LA-UR-79-2330] N80-15055
ELLIPTIC FUNCTIONS
Obtaining numerical values for the elliptic emission functions used in calculating electron emission from surfaces
[GEPP-TIS-443] N80-15961
ELONGATION
Investigation of elongation and its relationship to residual stresses in boron filaments
[AD-A074448] N80-15210
EMISSION SPECTRA
Time-resolved spectroscopic studies of surface reactions
[AD-A074952] N80-15216
Mass and emission spectrometry in the Analytical Chemistry Division of Oak Ridge National Laboratory
[ORNL/TM-6485] N80-15226
Solar flare spectroscopic diagnostics for wavelengths less than 2000 angstroms
[AD-A070569] N80-16018
ENDOCRINE SYSTEMS
Sleep stage organization: Neuro endocrine relations
N80-15809
ENDOTHERMIC REACTIONS
Demonstration of a nitrogen based carburizing atmosphere: Energy consumption of the endothermic generator
[CONS/5058-T1] N80-15591
ENERGY ABSORPTION
Energy absorption mechanisms during crack propagation in metal matrix composites
[NASA-CR-162574] N80-15232
Investigation of efficiency optimization in free electron lasers
[LA-UR-79-2179] N80-15400
ENERGY ABSORPTION FILMS
Design of photovoltaic systems for residential applications in the United States
[SAND-78-2186C] N80-15566
Status of the US Department of Energy photovoltaic concentrator development project
[SAND-78-2187C] N80-15578
Flywheel energy storage interface unit for photovoltaic applications
[COO-4064-44] N80-15609
ENERGY CONSERVATION
Impact of new instrumentation on advanced turbine research
[NASA-TM-79301] N80-15133
Design of residential buildings utilizing natural thermal storage
[DOE/TIC-10143] N80-15302
RF power saving in large storage rings
[SLAC-TN-79-2] N80-15353
Energy optimal use of waste paper
[COO-2893-4] N80-15595
National program plan for passive and hybrid solar heating and cooling
[DOE/CS-0089] N80-15598
Economic impacts of energy conservation and renewable energy sources
[UCRL-15087] N80-15633
Project evaluation and quality control — weatherization
[PB-301048/5] N80-15647
Energy conservation through point source recycle with high temperature hyperfiltration — textile industry
[PB-299183/4] N80-15688
ENERGY CONSUMPTION
Mission analysis for the Federal fuels from biomass program. Volume 3: Feedstock availability
[SAN-0115-T1] N80-15276
Measurement of energy to heat houses: Initial study
[PB-299448/2] N80-15304
Demonstration of a nitrogen based carburizing atmosphere: Energy consumption of the endothermic generator
[CONS/5058-T1] N80-15591
Energy supply and demand in the short term: 1979 and 1980
[DOE/EIA-0184/4] N80-15593
International energy assessment
[DOE/EIA-0184/1] N80-15594
Federal Energy Data System [FEDS] statistical summary update
[DOE/EIA-0192] N80-15630
Energy demand in the developing countries
[DOE/EIA-0183/10] N80-15631
ENERGY CONVERSION
Studies of metal-semiconductor interfaces in catalysis and energy conversion
[COO-4046-1] N80-15221
Conversion of cellulosic and waste polymer material to gasoline
[COO-2982-38] N80-15291
Investigation of the viability and cost effectiveness of solid fuel gasifiers close coupled to internal combustion engines for 200 kWe power generation
[DOE/RL/90476-13] N80-15293
Novel scheme for making cheap electricity with nuclear energy
[UCID-18155-REV-1] N80-15564
Research and evaluation of biomass resources/conversion/utilization systems [market/experimental analysis for development of a data base for a fuels from biomass model]
[COO-5022-5] N80-15576
Heat pump centered integrated community energy systems; System development
[ANL/ICES-TM-26] N80-15589
Utilization of waste heat from Federal facilities
[ORO-5523-T1] N80-15590
Turbomachinery options for an underground pumped hydroelectric storage plant
[CONF-790803-50] N80-15629
Flywheel energy storage and conversion system for photovoltaic applications
[COO-4094-48] N80-15635
ENERGY CONVERSION EFFICIENCY
Space solar cells: High efficiency and radiation damage
[NASA-TM-81387] N80-15554
Characterization of three types of silicon solar cells for SEPS deep space missions. Volume 1: Current-voltage characteristics of OCLI BSF/BSR 10 ohm-cm, and BSR 2 ohm-cm cells as a function of temperature and intensity
[NASA-TM-78253] N80-15562
ENERGY POLICY
Mission analysis for the Federal fuels from biomass program. Volume 3: Feedstock availability
[SAN-0115-T1] N80-15276
Production of sugarcane and tropical grasses as a renewable energy source
[DOE/CS/5912-T1] N80-15277
Report of the Alcohol Fuel Policy Review
[DOE/PE-0012] N80-15290
Economic analysis of small scale bioconversion units in New Mexico
[PB-301390/1] N80-15298
Decentralized solar photovoltaic energy systems
[LA-7866-TASE] N80-15565
Design of photovoltaic systems for residential applications in the United States
[SAND-78-2186C] N80-15566
Methodology for determining the configuration of the optimum solar total energy system
[SAND-79-0422] N80-15574
Research and evaluation of biomass resources/conversion/utilization systems [market/experimental analysis for development of a data base for a fuels from biomass model]
[COO-5022-5] N80-15576
Status of the US Department of Energy photovoltaic concentrator development project
[SAND-78-2187C] N80-15578
Heat pump centered integrated community energy systems; Systems development
[ANL/ICES-TM-30] N80-15588
Heat pump centered integrated community energy systems; System development
[ANL/ICES-TM-26] N80-15589
Utilization of waste heat from Federal facilities
[ORO-5523-T1] N80-15590
National program plan for passive and hybrid solar heating and cooling
[DOE/CS-0089] N80-15598
Department of Energy large solar central power systems semiannual review
[SAND-79-8508] N80-15602
Nuclear strategy of the Department of Energy
[DOE/ER-0025/D] N80-15605
Wharton annual energy model: Development and simulation results
[EPRI-EA-1115] N80-15606
Performance of residential solar heating and cooling system with flat-plate and evacuated tubular collectors: CSU Solar House 1
[COO-2577-17] N80-15616
Characterization of operating conditions for gas/water heat recovery steam generators
[ORNL/TM-6622] N80-15620
Environmental development plan ocean thermal energy conversion
[DOE/EDP-0034] N80-15621
Economic impacts of energy conservation and renewable energy sources
[UCRL-15087] N80-15633
Role of the government in the development of solar energy
[SERI/TP-52-138] N80-15639
Federal leasing and outer continental shelf energy production goals
[DOE/RA-0037] N80-15640
Fission energy program of the U.S. Department of Energy, FY 1980
[DOE/ET-0089] N80-15693
Fusion: A possible option for solving long-term energy problems
[PB-300692/1] N80-15946

Report to Congress on the economic impact of energy actions as required by public law 93-275, section 18-d
[DOE/PE-0007] N80-15993
ENERGY REQUIREMENTS
Mission analysis for the Federal fuels from biomass program. Volume 3: Feedstock availability
[SAN-0115-T1] N80-15276
Fuel utilization in residences
[EPRI-EA-894] N80-15604
Nuclear strategy of the Department of Energy
[DOE/ER-0025/D] N80-15605
Energy demand in the developing countries
[DOE/EIA-0183/10] N80-15631
MARKAL: A multiperiod linear-programming model for energy systems analysis [BNL version]
[BNL-26396] N80-15634
ENERGY SOURCES
Report of the Alcohol Fuel Policy Review
[DOE/PE-0012] N80-15290
Environmental overview of geothermal development: The Geysers-Calistoga KGRA. Volume 1: Issues and recommendations
[UCRL-52496-VOL-1] N80-15626
ENERGY STORAGE
Superconducting microwave pulse amplifier
[AD-A074056] N80-15331
Novel scheme for making cheap electricity with nuclear energy
[UCID-18153-REV-1] N80-15564
Feasibility of compressed air energy storage as a peak shaving technique in California. Volume 2
[SAN-1331-T1] N80-15596
Dynamic storage in solar total energy programs
[SAND-78-0958C] N80-15600
Long-term lithium battery tests
[SAND-79-0487] N80-15608
Flywheel energy storage interface unit for photovoltaic applications
[COO-4094-44] N80-15609
Lithium/iron sulfide batteries for electric vehicles
[CONF-781006-2] N80-15611
Laminated disk flywheel program
[UCRL-81772] N80-15612
Overview of flywheel energy storage component development
[SAND-78-1999C] N80-15623
Sandia composite-rim flywheel development
[SAND-78-1865C] N80-15624
Turbomachinery options for an underground pumped hydroelectric storage plant
[CONF-790803-50] N80-15629
Flywheel energy storage and conversion system for photovoltaic applications
[COO-4094-48] N80-15635
Solar mechanical energy storage program overview and systems analysis results
[SAND-79-1642C] N80-15637
Energy program at the Johns Hopkins University Applied Physics Laboratory
[PB-310245/7] N80-15648
Environmental development plan: Electric Energy Systems
[DOE/EDP-0038] N80-15669
Energy coupling in the plasma focus
[UCRL-81907] N80-15928
Energy storage system for automobile propulsion, 1978 study. 2: Detailed report
[UCRL-52553-VOL-2] N80-15995
ENERGY TECHNOLOGY
High temperature electrolysis — synthetic fuel production
[BNL-26331] N80-15227
Project planning document: High vechicle Alternative Fuels Utilization Program [AFUP]
[DOE/CS-0093] N80-15279
Ethanol/gasoline blends as automotive fuels
[CONF-790520-5] N80-15280
Commercialization strategy report for recovery of natural gas from unconventional sources
[TID-28848-DRAFT] N80-15287
Low temperature reaction path for coal liquefaction
[SAND-79-0738C] N80-15288
Report of the Alcohol Fuel Policy Review
[DOE/PE-0012] N80-15290
Conversion of coal-based methanol to ethylene and a gaseous fuel
[PB-301256/4] N80-15297
Candidate thermal energy storage technologies for solar industrial process heat applications
[NASA-TM-81380] N80-15560
Novel scheme for making cheap electricity with nuclear energy
[UCID-18153-REV-1] N80-15564
SERAPH implementation plans
[SERI/RR-34-152] N80-15570
Alternate cycles applied to ocean thermal energy conversion
[SERI/TP-34-180] N80-15571
Low temperature thermal energy storage: A state-of-the-art survey
[SERI/RR-54-164] N80-15583
Melting in phase-change thermal storage media
[COO-2993-1] N80-15584
Energy supply and demand in the short term: 1979 and 1980
[DOE/EIA-0184/4] N80-15593
Department of Energy large solar central power systems semiannual review
[SAND-79-8508] N80-15602
All-union scientific and technical conference on use of the earth's heat for the production of electric power - summary of reports
[CONF-751270-SUMM] N80-15615
Overview of flywheel energy storage component development
[SAND-79-1999C] N80-15623
PULSAR: An inductive pulse power source
[SAND-79-1246C] N80-15627
Solar/wind handbook for Hawaii: Technical applications for Hawaii, the Pacific Basin and sites worldwide with similar climatic conditions
[UCRL-15053] N80-15628
Feasibility study for enhancing the development of fusion energy
[EPRI-ER-778-SR] N80-15642
Water use alternatives for Navajo energy production
[LA-UR-79-1598] N80-15643
Energy program at the Johns Hopkins University Applied Physics Laboratory
[PB-310245/7] N80-15648
Environmental development plan: Electric Energy Systems
[DOE/EDP-0038] N80-15669
Development of the Rocky Mountain Energy and Environmental Technology Center: A preliminary analysis
[ORAU-156] N80-15670
ENERGY TRANSFER
Low pressure, high voltage discharges for the production of energetic electron beams
[AD-A074556] N80-15336
Optically pumped laser action and energy transfer in polyatomic molecules
[AD-A074985] N80-15389
Potential laser action in the He-metal vapor mixtures
[AD-A074594] N80-15393
Preliminary study of a recoil mechanism using Coulomb friction — for large bore cannon
[AD-A074203] N80-15414
ENGINE CONTROL
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine digital control system design report
[NASA-CR-134920] N80-15090
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine simulation report
[NASA-CR-134914] N80-15091
Quiet Clean Short-haul Experimental Engine [QCSEE] over-the-wing control system design report
[NASA-CR-135337] N80-15092
ENGINE DESIGN
Quiet Clean Short-haul Experimental Engine [QCSEE] Over The Wing [OTW] design report
[NASA-CR-134846] N80-15086
Quiet Clean Short-haul Experimental Engine [QCSEE]. Core engine noise measurements
[NASA-CR-135160] N80-15093
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] engine composite nacelle test report. Volume 1: Summary, aerodynamic and mechanical performance
[NASA-CR-159471] N80-15094
Quiet Clean Short-haul Experimental Engine [QCSEE] preliminary over-the-wing flight propulsion system analysis report
[NASA-CR-135296] N80-15095
Quiet Clean Short-haul Experimental Engine [QCSEE]. Composite fan frame subsystem test report
[NASA-CR-135010] N80-15098
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears test program
[NASA-CR-134669] N80-15103
Quiet Clean Short-haul Experimental Engine [QCSEE] clean combustor test report
[NASA-CR-134916] N80-15104
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears detailed design report
[NASA-CR-134872] N80-15106
Quiet Clean Short-haul Experimental Engine [QCSEE]: Hamilton Standard cam/harmonic drive variable pitch fan actuation system detail design report
[NASA-CR-134852] N80-15107
Quiet Clean Short-haul Experimental Engine [QCSEE]: The aerodynamic and mechanical design of the QCSEE under-the-wing fan
[NASA-CR-135009] N80-15109
Quiet Clean Short-haul Experimental Engine [QCSEE] UTW fan preliminary design
[NASA-CR-134842] N80-15111
Quiet Clean Short-haul Experimental Engine [QCSEE]: The aerodynamic and preliminary mechanical design of the QCSEE OTW fan
[NASA-CR-134841] N80-15112
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine composite fan blade design
[NASA-CR-134840] N80-15113
Quiet Clean Short-haul Experimental Engine [QCSEE] over-the-wing engine and control simulation results
[NASA-CR-135049] N80-15114
Quiet Clean Short-Haul Experimental Engine [QCSEE] ball spline pitch-change mechanism whirling test report
[NASA-CR-135354] N80-15115
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] boiler plate nacelle and core exhaust nozzle design report
[NASA-CR-135008] N80-15116
Quiet Clean Short-haul Experimental Engine [QCSEE] whirl test of cam/harmonic pitch change actuation system
[NASA-CR-135140] N80-15117
Quiet Clean Short-haul Experimental Engine [QCSEE]. Double-annular clean combustor technology development report
[NASA-CR-159483] N80-15121
Quiet Clean Short-Haul Experimental Engine [QSCEE]. Preliminary analyses and design report, volume 1
[NASA-CR-134838] N80-15123
Quiet Clean Short-Haul Experimental Engine [QCSEE]. Preliminary analyses and design report, volume 2
[NASA-CR-134839] N80-15124
Quiet Clean Short-Haul Experimental Engine [QCSEE] Over-The-Wng [OTW] propulsion system test report. Volume 1: Summary report
[NASA-CR-135323] N80-15125
Quiet Clean Short-Haul Experimental Engine [QCSEE] Over-The Wing [OTW] propulsion system test report. Volume 3: Mechanical performance
[NASA-CR-135325] N80-15126
An extension of engine weight estimation techniques to compute engine production cost
[AD-A074454] N80-15135
FRS composites for advanced gas turbine engine components
[AD-A074287] N80-15137
Advanced oxygen-hydrocarbon rocket engine study
[NASA-CR-161350] N80-15203
ENGINE INLETS
Comparison of inlet suppressor data with approximate theory based on cutoff ratio
[NASA-TM-81386] N80-15876
ENGINE NOISE
Quiet Clean Short-haul Experimental Engine [QCSEE]. Core engine noise measurements
[NASA-CR-135160] N80-15093
ENGINE PARTS
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine composite fan blade design report
[NASA-CR-135046] N80-15108
ENGINE TESTING LABORATORIES
Free-piston Stirling engine demonstration test plan
[COO-2764-T3] N80-15567
ENGINE TESTS
Quiet Clean Short-Haul Experimental Engine [QCSEE] Over-The-Wng [OTW] propulsion system test report. Volume 1: Summary report
[NASA-CR-135323] N80-15125
ENVIRONMENT EFFECTS
Environmental planning and assessment for highway vehicle use to alcohol fuels
[CONF-790520-2] N80-15281
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] N80-15526
Environmental overview of geothermal development: The Geysers-Calistoga KGRA. Volume 1: Issues and recommendations
[UCRL-52496-VOL-1] N80-15626
Environmental development plan photovoltaics
[DOE/EDP-0031] N80-15663
OTEC physical and climatic environmental impacts
[CONF-790631-11] N80-15664
Identification of environmental control technologies for geothermal development in the Imperial Valley of California
[UCRL-52548] N80-15668
Environmental assessment report: Solvent Refined Coal [SRC] systems
[PB-300383/7] N80-15676
Evaluation of the environmental effects of western surface coal mining, volume 1
[PB-300375/3] N80-15681
The investigation of man-made modifications of the ionosphere — effects of detonations and rocket exhaust
[NASA-CR-162579] N80-15707
Sleep disturbances in humans N80-15810
Environmental surveillance report for the INEL radioactive waste management complex
[TREE-1357] N80-15909
ENVIRONMENT PROTECTION
Environmental development plan ocean thermal energy conversion
[DOE/EDP-0034] N80-15621
Compliance status of major air pollution facilities
[PB-299959/7] N80-15700
Biological screening of complex samples from industrial/energy processes
[PB-300459/5] N80-15805

Improving the scientific and technical information available to the Environmental Protection Agency in its decision making process
[PB-300580/8] N80-16003
ENVIRONMENTAL ENGINEERING
Development of the Rocky Mountain Energy and Environmental Technology Center: A preliminary analysis
[ORAU-150] N80-15670
ENVIRONMENTAL MONITORING
Western energy sulfate/nitrate monitoring network
[PB-299238/6] N80-15685
Global observation of atmospheric ozone by satellite
[UCRL-83020] N80-15720
Applicability of a generic monitoring program for radioactive waste burial grounds at Oak Ridge National Laboratory and Idaho National Engineering Laboratory
[ORNL/SUB-7147-1] N80-15895
Environmental surveillance report for the INEL radioactive waste management complex
[TREE-1357] N80-15909
Shallow land burial: Experience and developments at Oak Ridge and Los Alamos
[LA-UR-79-1039] N80-15912
ENVIRONMENTAL TESTS
Climatic chamber testing aircraft, engines armament and avionics. Test operations procedure — environmental test chambers and facility for testing aircraft construction materials and engines
[AD-A074069] N80-15181
EPITAXY
Liquid phase epitaxial growth of gallium arsenide
[AR-001-446] N80-15947
EPOXY RESINS
Development of a special purpose spacecraft interior coating, phase 3
[NASA-CR-160441] N80-15199
Filament winding epoxy resins for elevated temperature service
[UCRL-52577] N80-15212
Environmentally enhanced crazing in polymers
[UCRL-82466] N80-15272
EQUATIONS OF MOTION
An analytic method for strong motion studies in layered media
[PB-301116/0] N80-15725
EQUATORIAL ATMOSPHERE
Airborne all-sky imaging of equatorial airglow
[AD-A073716] N80-15717
EQUATORIAL ELECTROJET
Temporal and spatial power spectrum studies of numerical simulations of type 2 gradient drift irregularities in the equatorial electrojet
[AD-A073447] N80-15716
EQUILIBRIUM EQUATIONS
Iterative metric method for solving the inverse Tokamak equilibrium problem — for plasma control using the magnetohydrodynamic equilibrium equation
[PPPL-1564] N80-15941
ERGODIC PROCESS
Ergodic theorems for nonlinear contraction semigroups in a Hilbert space
[ANL-79-50] N80-15860
ERROR ANALYSIS
Loran digital phase-locked loop and RF front-end system error analysis
[NASA-CR-162751] N80-15065
Error characteristics of satellite-derived winds
[PB-300734/9] N80-15759
ERROR DETECTION CODES
Care 3, Phase I, volume I
[NASA-CR-159122] N80-15423
Care 3, phase I, volume 2
[NASA-CR-159123] N80-15424
ERRORS
Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts — wheat
N80-15454
ESTIMATES
Accuracy and performance of LACIE area estimates — wheat yield in the U.S. Great Plains States
N80-15487
Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world
N80-15488
ESTIMATING
LACIE large area acreage estimation — United States of America
N80-15453
Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts — wheat
N80-15454
Growth stage estimation — crop calendars
N80-15458
Methods for segment wheat area estimation
N80-15491
Estimating crop proportions from remotely sensed data
N80-15492
Signature extension methods in crop area estimation
N80-15501
Precise relative location estimation from satellite laser observations — Geos 3 satellite
[NASA-CR-159953] N80-15536
Estimation of variance components
[AD-A074223] N80-15867
ETHYL ALCOHOL
Ethanol/gasoline blends as automotive fuels
[CONF-790520-5] N80-15280
ETHYLENE
Conversion of coal-based methanol to ethylene and a gaseous fuel
[PB-301256/4] N80-15297
EULER-LAGRANGE EQUATION
Integrability conditions for the existence of a Lagrangian in Newtonian mechanics and field theory — Pauli's exclusion principle
[COO-4742-1] N80-15972
EVALUATION
An evaluation of activated carbon for drinking water treatment
[PB-299968/8] N80-15229
Evaluation of stationary source particulate measurement methods. Volume 5: Secondary lead smelters
[PB-300337/3] N80-15701
EVAPOTRANSPIRATION
Topographical characteristics through the study of the thermal and hydrological dissimilarity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
[E80-10020] N80-15447
EVASIVE ACTIONS
Semi-analytical formulae for real-time implementation of optimal missile avoidance strategies
[TAE-352] N80-15834
A differential dynamic programming algorithm for the solution of the three-dimensional optimal missile avoidance
[TAE-351] N80-15835
EVOKED RESPONSE [PSYCHOPHYSIOLOGY]
Evoked potentials in unrestrained cats to a combination of clicks with painful electrocutaneous stimuli
[NASA-TM-75941] N80-15780
EXCIMER LASERS
A simple model for calculating the index of refraction of neon 1 and neon [3S] in the cavity of a xenon fluoride laser
[AD-A074580] N80-15392
EXCITATION
Advanced excitation techniques for tunable infrared lasers
[AD-A074732] N80-15390
Potential laser action in the He-metal vapor mixtures
[AD-A074594] N80-15393
EXHAUST EMISSION
Environmental planning and assessment for highway vehicle use to alcohol fuels
[CONF-790520-2] N80-15281
Measurement of particulates
N80-15652
Ice nuclei measurements from solid rocket motor effluents
N80-15653
Ground-based measurements of DM-2 rocket exhaust effluents using fixed-flow samplers and electrets
N80-15654
Response of selected plant and insect species to simulated SRM exhaust mixtures and to exhaust components from SRM fuels
N80-15657
Analysis of the measured effects of the principal exhaust effluents from solid rocket motors
[NASA-CR-3136] N80-15660
Emissions characteristics of six high-speed diesel engines — for use in underground mines
[BETC/TPR-78/7] N80-15667
EXHAUST GASES
Quiet Clean Short-haul Experimental Engine [QCSEE] clean combustor test report
[NASA-CR-134916] N80-15104
Quiet Clean Short-haul Experimental Engine [QCSEE]
[NASA-CR-159473] N80-15120
Effects of inspection and maintenance programs on fuel economy
[PB-297583/7] N80-15420
Ground-based measurements of DM-2 rocket exhaust effluents using fixed-flow samplers and electrets
N80-15654
EPA utility FGD [Flue Gas Desulfurization] survey: December 1978 - January 1979 — electric power plants
[PB-299399/6] N80-15682
EXHAUST NOZZLES
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] boiler plate nacelle and core exhaust nozzle design report
[NASA-CR-135008] N80-15116
EXOBIOLOGY
Aerospace medicine and biology: A continuing bibliography, supplement 200
[NASA-SP-7011(200)] N80-15787
EXPANSION
Calculation of plane sudden expansion flow via vortex dynamics
[SAND-79-8679] N80-15374
EXPERIMENTAL DESIGN
Experimental studies of the formation/deposition of sodium sulfate in/from combustion gases — hot corrosion of gas turbine engine components
[NASA-CR-159753] N80-15131
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
The design and implementation of an inexpensive microprocessor development system for the Z-80 microprocessor
[AD-A077927] N80-15829
EXTERNALLY BLOWN FLAPS
The YC-14 upper surface blown flap: A unique control surface
N80-15157
EYE [ANATOMY]
Special session on vision
[LBL-9160] N80-15802

F

F-15 AIRCRAFT
Correlation of F-15 flight and wind tunnel test control effectiveness
N80-15152
FACE CENTERED CUBIC LATTICES
Shock propagation in the three-dimensional lattice, 2. Method of calculation
[AD-A074263] N80-15316
FACTOR ANALYSIS
Linear feature selection with applications
N80-15496
Feature extraction applied to agricultural crops as seen by LANDSAT
N80-15497
FAILURE ANALYSIS
Tantalum fabrication — microstructural analysis
[UCID-18152] N80-15256
A relation between semiempirical fracture analyses and R-curves
[NASA-TP-1600] N80-15420
The fracture of a parachute hook: A case study of the role of materials parameters in reliability analysis
[AR-001-591] N80-15429
FAR ULTRAVIOLET RADIATION
Vaccum ultraviolet electronic properties of liquids
[ORO-3861-28] N80-15217
FARM CROPS
Use of thermal infrared and colour infrared imagery to detect crop moisture stress — Alberta, Canada
[E80-10036] N80-15530
HCMM/soil moisture experiment — Alberta, Canada
[E80-10037] N80-15531
Obtaining timely crop area estimates using ground-gathered and LANDSAT data
[PB-300825/7] N80-15540
FATIGUE [BIOLOGY]
Sleep disturbance and performance
N80-15814
FATIGUE [MATERIALS]
Fatigue failure of composite laminates — graphite-epoxy composite materials
[AD-A073499] N80-15209
Fatigue crack propagation in 21/4 Cr-1 Mo steel
[CONF-790802-41] N80-15250
Response of nonlinear structural panels subjected to high intensity noise
[AD-A074966] N80-15432
Crack tip plasticity associated with corrosion assisted fatigue
[AD-A073835] N80-15435
FATIGUE TESTS
Model 540 rotor blade crack propagation investigation
[AD-A074734] N80-15081
Alternate immersion stress corrosion testing of 5083 aluminum
[RFP-2645] N80-15257
FEASIBILITY ANALYSIS
Evaluation of feasibility of prestressed concrete for use in wind turbine blades
[NASA-CR-159725] N80-15553
Feasibility study for enhancing the development of fusion energy
[EPRI-ER-779-SR] N80-15642
FEDERAL BUDGETS
Role of the government in the development of solar energy
[SERI/TP-52-138] N80-15639
FEEDBACK CONTROL
Design criteria for optimal flight control systems — study of optimal flight control systems engineering for feedback control
[AD-A074092] N80-15139
Control systems design for large flexible space structures
[NASA-CR-162582] N80-15301
FERMI SURFACES
Fermi surface measurements in A-15 compounds
[CONF-790653-13] N80-15960
FERROMAGNETISM
On 1/N expansions and the phased diagram of discrete lattice gauge theories with matter fields — Ising model
N80-15968
FIBER COMPOSITES
FRS composites for advanced gas turbine engine components
[AD-A074287] N80-15137

LLL materials program for fiber-composite flywheels
[UCRL-83043] N80-15632

FIBER OPTICS
Light communication systems, volume 3. A bibliography with abstracts
[NTIS/PS-79/0998/9] N80-15327
Fiber optics, volume 3. A bibliography with abstracts
[NTIS/PS-79/1006/5] N80-15924

FIELD THEORY (PHYSICS)
Bilocal field theory and a model for meson spectroscopy, part 1. Trident production by high energy charged particles on nuclei, part 2
[IS-T-861] N80-15689
Bifurcation and stability in Yang-Mills theory with sources
[COO-3069-655] N80-15971
Integrability conditions for the existence of a Lagrangian in Newtonian mechanics and field theory — Pauli's exclusion principle
[COO-4742-1] N80-15972

FIGHTER AIRCRAFT
Wind tunnel measurements and analysis of some unusual control surfaces on two swept wing fighter configurations
N80-15155
Flaperon control: The versatile surface for fighter aircraft
N80-15158
Control considerations for CCV fighters at high angles of attack
N80-15160
Fin design with ACT in the presence of strakes
N80-15161
Wind tunnel investigation of controls for DF on a fighter-type configuration of higher angles of attack
N80-15166
Forebody vortex blowing: A novel control concept to enhance departure/spin recovery characteristics of fighter and trainer aircraft
N80-15172

FILAMENT WINDING
Filament winding epoxy resins for elevated temperature service
[UCRL-52577] N80-15212

FILE MAINTENANCE [COMPUTERS]
Inverted file facility: User's guide
[AD-A074081] N80-15982
Common file system reference manual, PIM-5
[LA-5525-M-VOL-5] N80-15988

FILM COOLING
Thermo-mechanical stress analysis of advanced turbine blade cooling configuration
[AD-A074098] N80-15136
Full-coverage film cooling on flat, isothermal surfaces: Data and predictions
[NASA-CR-3219] N80-15363

FILTRATION
Review of water intake screening options for coastal water users with recommendations for Ocean Thermal Energy Conversion [OTEC] plants
[ANL/OTEC-BCM-005] N80-15572
Energy conservation through point source recycle with high temperature hyperfiltration — textile industry
[PB-299183/4] N80-15688

FINITE DIFFERENCE THEORY
A users guide for A344: A program using a finite difference method to analyze transonic flow over oscillating airfoils
[NASA-CR-159141] N80-15052

FINITE ELEMENT METHOD
Simulation of LNG vapor spread and dispersion by finite element methods
[UCRL-82441] N80-15282
Linear and nonlinear symmetrically loaded shells of revolution approximated with the finite element method
[LA-7538-MS] N80-15439
HONDO II: A finite element computer program for the large deformation dynamic response of axisymmetric solids
[SAND-78-0422] N80-15442
Finite element method for studying the transient nonlinear thermal creep of geological structures
[LA-7883-MS] N80-15718
Finite element method for the solution of a potential theory integral equation
[LBL-9504] N80-15859
Comparison of boundary element and finite element methods in two-dimensional inelastic analysis
[COO-2733-22] N80-15864

FINNED BODIES
Studies of non-linear aerodynamic characteristics of finned slender bodies at high angles of attack
[TAE-349] N80-15032
Fin design with ACT in the presence of strakes
N80-15161

FIRE CONTROL
Control integration technology impact — as a basis for improving the combat effectiveness of all tactical aircraft
N80-15162
Additional software developments for the HP-21 MX
[AD-A074068] N80-15846

FIREPROOFING
NASA technical advances in aircraft occupant safety — clear air turbulence detectors, fire resistant materials, and crashworthiness
[NASA-TM-80851] N80-15060

FLAME PROBES
Influence of geometric and kinematic factors on combustion performance
[TAE-350] N80-15214

FLAPPING HINGES
Effects of primary rotor parameters on flapping dynamics
[NASA-TP-1431] N80-15138

FLAPS [CONTROL SURFACES]
Direct side force and drag control with the aid of pylon split flaps
N80-15163
In-flight measured characteristics of combined flap-spoiler direct lift controls
N80-15165
Some investigations concerning the effects of gaps and vortex generators on elevator efficiency and of landing flap sweep on aerodynamic characteristics
N80-15178

FLASH LAMPS
Applying a compensated pulsed alternator to a flashlamp load for NOVA
[UCRL-82473] N80-15408

FLAT PLATES
Full-coverage film cooling on flat, isothermal surfaces: Data and predictions
[NASA-CR-3219] N80-15363

FLEXIBLE BODIES
Control systems design for large flexible space structures
[NASA-CR-162582] N80-15201

FLEXIBLE WINGS
Analyses and tests of the B-1 aircraft structural mode control system
[NASA-CR-144687] N80-15073

FLIGHT CHARACTERISTICS
Comparison of international flutter requirements and flutter freedom substantiation of light aircraft in the USA
N80-15142
Control integration technology impact — as a basis for improving the combat effectiveness of all tactical aircraft
N80-15162

FLIGHT CONDITIONS
Application of the SIRS concept to Navy helicopters — systems analysis of flight data recorders of flight conditons of helicopters for structural analysis
[AD-A074801] N80-15030

FLIGHT CONTROL
Design criteria for optimal flight control systems — study of optimal flight control systems engineering for feedback control
[AD-A074092] N80-15139
Flight control and configuration design considerations for highly maneuverable aircraft
N80-15154

FLIGHT CREWS
Management of irregular rest and activity
N80-15819

FLIGHT RECORDERS
Application of the SIRS concept to Navy helicopters — systems analysis of flight data recorders of flight conditons of helicopters for structural analysis
[AD-A074801] N80-15030

FLIGHT SAFETY
Low-level wind shear: A critical review — aviation safety
[PB-300715/0] N80-15764

FLIGHT SIMULATION
The effects of motion and g-seat cues on pilot simulator performance of three piloting tasks
[NASA-TP-1601] N80-15069

FLIGHT SIMULATORS
Effects of varying visual display characteristics of the T-4G, a T-37 flight simulator
[AD-A071410] N80-15180
High speed function generation for research and project support
[AD-A075972] N80-15197

FLIGHT STRESS [BIOLOGY]
Biochemical indices of stress: Biochemical aspects of the stress response
N80-15812

FLIGHT TESTS
Data reduction software for LORAN-C flight test evaluation
[NASA-CR-162730] N80-15064
CH-46 composite rotor blade flight stress survey data. Volume 3: Plotted forward rotor blade chord, torsion and absolute loads
[AD-A075612] N80-15077
Analysis of low-speed helicopter flight test data
[AD-A074141] N80-15079
JA-6A circulation control wing contractor flight demonstration
[AD-A074888] N80-15080
Correlation of F-15 flight and wind tunnel test control effectiveness
N80-15152

FLOW CHARACTERISTICS
Displacement characteristics of a glass-ceramic insulator in a vacuum tube envelope sealing process
[GEPP-TIS-445] N80-15269

FLOW DISTRIBUTION
Aerodynamic interaction on a close-coupled canard wing configuration
N80-15175
On the effects of gaps on control surface characteristics
N80-15176
Numerical prediction of flows over and in the near wake behind axisymmetric, self-propelled bodies
[AD-A074971] N80-15271
User's guide for a system of computer programs to predict flows over and in the near wake behind axisymmetric, self-propelled bodies
[AD-A074972] N80-15272
Calculation of plane sudden expansion flow via vortex dynamics
[SAND-79-8679] N80-15374

FLOW EQUATIONS
Flow and drag formulas for simple quadrics — pressure drag and flow equations for an ellipsoid in incompressible fluids
[NACA-253] N80-15043
Flow and force equations for a body revolving in a fluid
[NACA-323] N80-15044
The dynamics of material layers
[AD-A073726] N80-15740

FLOW GEOMETRY
Computation of three-dimensional flow in turbofan mixers and comparison with experimental data
[NASA-TM-81410] N80-15364

FLOW STABILITY
Development of an alternative to the E9 procedure for predicting boundary-layer transition
[AD-A074071] N80-15369
Numerical modeling of baroclinic instability
[NASA-CR-161363] N80-15706
Features of sound propagation through and stability of a finite shear layer
[NASA-CR-162465] N80-15870

FLOW VELOCITY
The mechanism of fluid resistance
N80-15035
Flow and force equations for a body revolving in a fluid
[NACA-323] N80-15044

FLUES
EPA utility FGD [Flue Gas Desulfurization] survey: December 1978 - January 1979 — electric power plants
[PB-299390/6] N80-15682

FLUID DYNAMICS
AFFDL experience in active control technology
N80-15159
Continued development of fluid dynamics models
[AD-A073846] N80-15367
Scale modeling of finite length fluid annular gaps for flow-induced vibration testing
[ANL-CT-79-40] N80-15436

FLUIDIZED BED PROCESSORS
Proceedings of the Hydride Storage Reservoir Symposium/Workshop
[BNL-26523] N80-15286

FLUORESCENCE
Optically pumped laser action and energy transfer in polyatomic molecules
[AD-A074985] N80-15389

FLUORIDES
Activation volumes of some superionic conductors with the fluorite structure
[COO-1198-1264] N80-15349

FLUORITE
Activation volumes of some superionic conductors with the fluorite structure
[COO-1198-1264] N80-15349

FLUOROCARBONS
Development of a special purpose spacecraft interior coating, phase 3
[NASA-CR-160441] N80-15199

FLUTTER
General theory of aerodynamic instability and the mechanism of flutter
[NACA-496] N80-15047
Comparison of international flutter requirements and flutter freedom substantiation of light aircraft in the USA
N80-15142

FLUTTER ANALYSIS
Classical aerodynamic theory
[NASA-RP-1050] N80-15033
Low cost aircraft flutter clearance — conference
[AGARD-CP-276] N80-15141
The state-of-the-art of flutter substantiation procedures among US general aviation manufacturers
N80-15143
An empirical approach for checking flutter stability of gliders and light aircraft
N80-15144
Dynamic identification of light aircraft structures and their flutter certification
N80-15145
A flutter-speed formula for wings of high aspect ratio
N80-15147
The minimum cost approach to flutter clearance
N80-15148
Leading edge flutter of a supercavitating hydrofoil
[AD-A074636] N80-15301

FLUX [RATE]
Low pressure, high voltage discharges for the production of energetic electron beams
[AD-A074556] N80-15336
Plasma crowbars in cylindrical flux compression experiments — for simulating zeta pinch flux rate in plasma cylinders
[UCRL-82147] N80-15939
FLUX DENSITY
On the output of acoustical sources
[NASA-CR-162578] N80-15072
FLY BY WIRE CONTROL
Flaperon control: The versatile surface for fighter aircraft N80-15158
FLYWHEELS
Filament winding epoxy resins for elevated temperature service
[UCRL-52577] N80-15212
Structural modeling of a thick-rim rotor
[SAND-78-1941C] N80-15416
Flywheel energy storage interface unit for photovoltaic applications
[COO-4094-44] N80-15609
Laminated disk flywheel program
[UCRL-81772] N80-15612
Critical speeds and natural frequencies of rim-type composite-material flywheels
[SAND-78-7049] N80-15622
Overview of flywheel energy storage component development
[SAND-78-1999C] N80-15623
Sandia composite-rim flywheel development
[SAND-78-1865C] N80-15624
LLL materials program for fiber-composite flywheels
[UCRL-83043] N80-15632
Flywheel energy storage and conversion system for photovoltaic applications
[COO-4094-46] N80-15635
Energy program at the Johns Hopkins University Applied Physics Laboratory
[PB-300245/7] N80-15648
FOCUSING
A reflex triode with geometric focusing
[AD-A074453] N80-15341
Attempt to measure sonic boom caustics supersonic HVAR rocket sleds
[SAND-78-1541] N80-15678
Calculation of quadrupolar focusing of a linear accelerator and of beam adaptation in the presence of a space charge
[LA-TR-79-18] N80-15901
FOG
Refinement of a statistical diagnostic model of marine fog using FNWC model output parameters
[AD-A075959] N80-15730
Considerations in the optical characterization of the atmosphere — meteorological parameters and optical properties of fog and haze
[AD-A073480] N80-15747
FORCE DISTRIBUTION
Forced two phase helium cooling of large superconducting magnets
[LBL-9701] N80-15373
FOREBODIES
Forebody vortex blowing: A novel control concept to enhance departure/spin recovery characteristics of fighter and trainer aircraft N80-15172
FORGING
Evaluation of forgeability of steels by notch compression method
[RFP-TRANS-273] N80-15249
FOSSIL FUELS
Federal leasing and outer continental shelf energy production goals
[DOE/RA-0037] N80-15640
FOUNDATIONS
Analysis of field test results for single-axis-tracking solar collector foundations
[SAND-79-7023] N80-15986
FRACTURE MECHANICS
A relation between semiempirical fracture analyses and R-curves
[NASA-TP-1600] N80-15428
FRACTURE STRENGTH
A relation between semiempirical fracture analyses and R-curves
[NASA-TP-1600] N80-15428
Stress-intensity factors and crack-opening displacements for round compact specimens — fracture toughness of metallic materials
[NASA-TM-80174] N80-15430
FRACTURES [MATERIALS]
Analysis of a unidirectional composite containing broken fibers and matrix damage
[NASA-CR-159185] N80-15205
FRANCK-CONDON PRINCIPLE
Theory of chemical kinetics — franck-condon approximation
[COO-2873-3] N80-15223
FREE ELECTRON LASERS
Stimulated emission by relativistic electrons traversing a periodic magnetic field
[AD-A073888] N80-15396
Investigation of efficiency optimization in free electron lasers
[LA-UR-79-2176] N80-15400
FREQUENCIES
Particle dynamics in ion linear accelerator operating in double frequency regime
[LA-TR-79-19] N80-15900
FREQUENCY CONTROL
Antenna sidelobe and interference reduction. A bibliography with abstracts
[NTIS/PS-79/1013/4] N80-15325
FREQUENCY CONVERTERS
RF power saving in large storage rings
[SLAC-TN-79-2] N80-15353
FREQUENCY MODULATION
Laser intracavity modulation and stabilization
[AD-A074679] N80-15395
FREQUENCY MULTIPLIERS
Tripling of CO2 laser radiation in DBr, DCl and Se
[COO-4253-7] N80-15406
FRESNEL REFLECTORS
Micro-fresnel structures for microscopy of laser generated bright X-ray sources
[UCRL-82684] N80-15401
FRICTION
Preliminary study of a recoil mechanism using Coulomb friction — for large bore cannon
[AD-A074203] N80-15434
FRICTION FACTOR
Vessel discharge by friction dominated tube flow
[UCRL-82801] N80-15375
FRICTIONLESS ENVIRONMENTS
The inertia coefficients of an airship in a frictionless fluid
[NACA-164] N80-15042
FUEL CELLS
Prediction of current distribution in a molten carbonate fuel cell
[CONF-781063-1] N80-15613
FUEL COMBUSTION
Effect of sodium, potassium, magnesium, calcium, and chlorine on the high temperature corrosion of IN-100, U-700, IN-792, and Mar M-509 — coal-derived liquid fuel combustion in turbines
[NASA-TM-79309] N80-15235
FUEL CONSUMPTION
Fuel utilization in residences
[EPRI-EA-894] N80-15604
FUEL TESTS
Project planning document: High vechicle Alternative Fuels Utilization Program [AFUP]
[DOE/CS-0093] N80-15279
FURNACES
Directional solidification at ultra-high thermal gradient
[NASA-CR-159797] N80-15300
FUSION REACTORS
Feasibility study for enhancing the development of fusion energy
[EPRI-ER-778-SR] N80-15642
Compatibility of structural materials with fusion reactor coolant and breeder fluids
[CONF-790125-77] N80-15906
Development of imploding liner systems for the NRL LINUS program
[AD-A075005] N80-15926
Analysis of the early phase of Tokamak plasma ohmic heating
[WFPS-TME-79-018] N80-15927
Research on the HYLIFE liquid-first-wall concept for future laser fusion reactors
[UCRL-15033] N80-15930
Parametric study of the Tormac fusion reactor concept
[LA-7935-MS] N80-15931
Mouse Carlo simulation of neutral-beam injection for mirror fusion reactors
[COO-2218-133] N80-15932
Fusion: A possible option for solving long-term energy problems
[PB-300692/1] N80-15946

G

GALLIUM ARSENIDES
Analysis of GaAs and Si solar cell arrays for earth orbital and orbit transfer missions
[NASA-TM-81383] N80-15204
Liquid phase epitaxial growth of gallium arsenide
[AR-001-666] N80-15947
Topographic examination of semiconductor systems
[AD-A075007] N80-15953
GAPS
On the effects of gaps on control surface characteristics N80-15176
Some investigations concerning the effects of gaps and vortex generators on elevator efficiency and of landing flap sweep on aerodynamic characteristics N80-15178
GARP ATLANTIC TROPICAL EXPERIMENT
GATE radar CAPPI derivation for three-dimensional reflectivity analyses
[PB-301263/0] N80-15765
GAS DETECTORS
Response characteristics of optical probes — for liquid-vapor interfaces
[BNL-NUREG-24479] N80-15385
GAS DISCHARGES
Low pressure, high voltage discharges for the production of energetic electron beams
[AD-A074556] N80-15336
Vessel discharge by friction dominated tube flow
[UCRL-82801] N80-15375
GAS TURBINE ENGINES
Theory of deposition of condensable impurities on surfaces immersed in combustion gases
[NASA-CR-159716] N80-15130
Experimental studies of the formation/deposition of sodium sulfate in/from combustion gases — hot corrosion of gas turbine engine components
[NASA-CR-159753] N80-15131
Impact of new instrumentation on advanced turbine research
[NASA-TM-79301] N80-15133
Thermo-mechanical stress analysis of advanced turbine blade cooling configuration
[AD-A074096] N80-15136
FRS composites for advanced gas turbine engine components
[AD-A074287] N80-15137
Sintered silicon nitrode recuperator fabrication
[NASA-CR-159706] N80-15263
Plasma-sprayed dual density ceramic turbine seal system
[NASA-CR-159739] N80-15411
GAS TURBINES
Multiple jet impingement heat transfer characteristic: Experimental investigation of in-line and staggered arrays with crossflow
[NASA-CR-3217] N80-15360
GASEOUS DIFFUSION
Simulation of LNG vapor spread and dispersion by finite element methods
[UCRL-82441] N80-15282
GASES
Estimating the gas and dye quantities for modified tracer technique measurement of stream reaeration coefficients
[PB-299015/8] N80-15690
GASIFICATION
Conversion of cellulosic and waste polymer material to gasoline
[COO-2982-38] N80-15291
Investigation of the viability and cost effectiveness of solid fuel gasifiers close coupled to internal combustion engines for 200 kWe power generation
[DOE/RL-90476-13] N80-15293
GASOHOL [FUEL]
Environmental planning and assessment for highway vehicle use to alcohol fuels
[CONF-790520-2] N80-15281
Report of the Alcohol Fuel Policy Review
[DOE/PE-0012] N80-15290
GASOLINE
Ethanol/gasoline blends as automotive fuels
[CONF-790520-5] N80-15280
GATES [CIRCUITS]
Very fast, high-peak-power, planar triode amplifiers for driving optical gates
[UCRL-82536] N80-15358
GAUGE INVARIANCE
On 1/N expansions and the phased diagram of discrete lattice gauge theories with matter fields — Ising model N80-15968
GAUSS EQUATION
QINTEG: A program for computing Gaussian quadrature coefficients
[AD-A073974] N80-15845
GEARS
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears test program
[NASA-CR-134669] N80-15103
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears bearing development program
[NASA-CR-134890] N80-15105
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears detailed design report
[NASA-CR-134672] N80-15106
GENERAL AVIATION AIRCRAFT
Design study of a low cost civil aviation GPS receiver system
[NASA-CR-159176] N80-15062
The state-of-the-art of flutter substantiation procedures among US general aviation manufacturers N80-15143
GEOCHEMISTRY
Geothermal energy development from the Salton Trough to the High Cascades — Cerro Prieto, Lower California and Mt. Hood, Oregon
[LBL-8703] N80-15568
Trace element geochemistry of the South Atlantic bight
[DOE/EV-00890-3] N80-15774
Geochemistry of lunar and planetary processes
[NASA-CR-162583] N80-16015
GEODESY
Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results
[NASA-CR-156859] N80-15446
GEOLOGICAL SURVEYS
Geologic application of thermal inertia imaging using HCMM data — Cuprite, Elko, and Golfield test areas, Nevada
[E80-10035] N80-15529

Geothermal energy development from the Salton Trough to the High Cascades — Cerro Prieto, Lower California and Mt. Hood, Oregon
[LBL-8703] N80-15568
Applicability of a generic monitoring program for radioactive waste burial grounds at Oak Ridge National Laboratory and Idaho National Engineering Laboratory
[ORNL/SUB-7167-1] N80-15895
GEOLOGY
Finite element method for studying the transient nonlinear thermal creep of geological structures
[LA-7883-MS] N80-15718
Geologic factors in nuclear waste disposal — computer simulation of radioactive waste transport from underground storage
[UCRL-52522] N80-15896
Reports of planetary geology program, 1979 - 1980 — bibliographies
[NASA-TM-81776] N80-16010
GEOMETRICAL OPTICS
Steady-state point-source excitation of a laminated composite
[AD-A074336] N80-15207
Ray and wave optics of integrable and stochastic systems
[LBL-9445] N80-15921
GEOMETRY
Influence of geometric and kinematic factors on combustion performance
[TAE-350] N80-15214
GEOMORPHOLOGY
Reports of planetary geology program, 1979 - 1980 — bibliographies
[NASA-TM-81776] N80-16010
GEOPHYSICS
Physics of mantle and core minerals
[E80-10038] N80-15532
Rock mass characterization for storage of nuclear waste in granite
[LBL-8570] N80-15911
Solar-geophysical data number 414, supplement, February 1979. Part 2: Comprehensive reports. DTA for December 1978, November 1978 and miscellanea
[PB-299340/0] N80-16020
Solar geophysical data number 418, June 1979. Part 1: Prompt reports. Data for May 1979, April 1979. Explanation of data reports issued as number 414 [supplement] February 1979
[PB-299694/0] N80-16021
GEOS SATELLITES [ESA]
Survey of satellite sensors and data with application to OTEC resource and operations requirements
[PB-300297/9] N80-15543
GEOS 3 SATELLITE
Precise relative location estimation from satellite laser observations — Geos 3 satellite
[NASA-CR-159953] N80-15536
GEOSYNCHRONOUS ORBITS
Analysis of GaAs and Si solar cell arrays for earth orbital and orbit transfer missions
[NASA-TM-81383] N80-15204
GEOTHERMAL ENERGY CONVERSION
All-union scientific and technical conference on use of the earth's heat for the production of electric power - summary of reports
[CONF-751270-SUMM] N80-15615
Use of geothermal energy for desalination in New Mexico: A feasibility study
[PB-299271/7] N80-15645
Identification of environmental control technologies for geothermal development in the Imperial Valley of California
[UCRL-52548] N80-15668
GEOTHERMAL RESOURCES
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] N80-15527
Geological and geothermal data use investigations for application explorer mission-A, heat capacity mapping mission
[E80-10033] N80-15528
Geothermal energy development from the Salton Trough to the High Cascades — Cerro Prieto, Lower California and Mt. Hood, Oregon
[LBL-8703] N80-15568
District space heating potential of low temperature hydrothermal geothermal resources in the southwestern United States — using computerized simulation
[NMEI-10-1] N80-15582
All-union scientific and technical conference on use of the earth's heat for the production of electric power - summary of reports
[CONF-751270-SUMM] N80-15615
Use of geothermal energy for desalination in New Mexico: A feasibility study
[PB-299271/7] N80-15645
GERMANIUM ALLOYS
Electrical and optical properties of high purity p-type single crystals of GeFe2O4
[AD-A073998] N80-15949
GEYSERS
Environmental overview of geothermal development: The Geysers-Calistoga KGRA. Volume 1: Issues and recommendations
[UCRL-52496-VOL-1] N80-15626
GLASS
Displacement characteristics of a glass-ceramic insulator in a vacuum tube envelope sealing process
[GEPP-TIS-445] N80-15269
Crystallization, flow and thermal histories of lunar and terrestrial compositions
[NASA-CR-162445] N80-16013
GLIDERS
Low cost aircraft flutter clearance — conference [AGARD-CP-276] N80-15145
An empirical approach for checking flutter stability of gliders and light aircraft
N80-15146
A simplified ground vibration test procedure for sailplanes and light aircraft
N80-15146
GLOBAL ATMOSPHERIC RESEARCH PROGRAM
Simultaneous cabin and ambient ozone measurements on two Boeing 747 airplanes, volume 1
[NASA-TM-79166] N80-15059
GLOBAL POSITIONING SYSTEM
Design study of a low cost civil aviation GPS receiver system
[NASA-CR-159176] N80-15062
GLYCINE
The crystal structure and variable temperature Sn-119m Mossbauer study of trimethyltin glycinate, a one-dimensional, amino-bridged polymer
[AD-A074383] N80-15955
GOLD COATINGS
Gold plating metallized alumina ceramics
[GFPP-TIS-380] N80-15254
GOVERNMENT/INDUSTRY RELATIONS
Role of the government in the development of solar energy
[SERI/TP-52-138] N80-15639
Factors related to the implementation and diffusion of new technologies: A pilot study — effects of government intervention
[PB-298998/6] N80-15978
GRAINS [FOOD]
Econometric models for predicting confusion crop ratios
N80-15450
Classification and mensuration of LACIE segments
N80-15455
Analysis of scanner data for crop inventories — North Dakota
[E80-10040] N80-15534
GRANITE
Heat transfer studies in salt and granite
[ORNL/ENG/TM-14] N80-15581
Technical concept for a test of geologic storage of spent reactor fuel in the climax granite, Nevada Test Site
[UCRL-52796] N80-15899
Rock mass characterization for storage of nuclear waste in granite
[LBL-8570] N80-15911
GRANULAR MATERIALS
Evaluation of granular bed filters for high-temperature/high-pressure particulate control — pollution control
[PB-299195/1] N80-15672
GRAPHITE-EPOXY COMPOSITE MATERIALS
Quiet Clean Short-haul Experimental Engine [QCSEE]. Composite fan frame subsystem test report
[NASA-CR-135010] N80-15098
Quiet Clean Short-haul Experimental Engine [QCSEE] composite fan frame design report
[NASA-CR-135278] N80-15110
Fatigue failure of composite laminates — graphite-epoxy composite materials
[AD-A073899] N80-15209
Analyses of moisture in polymers and composites
[NASA-CR-159745] N80-15264
GRAPHS [CHARTS]
Graphic construction of Joukowski wings
[NACA-TM-336] N80-15037
GRASSES
Production of sugarcane and tropical grasses as a renewable energy source
[DOE/CS/5912-T1] N80-15277
GRAVITATIONAL EFFECTS
Baroclinic instability with variable gravity: A perturbation analysis
[NASA-TP-1586] N80-15445
GREAT PLAINS CORRIDOR [NORTH AMERICA]
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
Accuracy assessment: The statistical approach to performance evaluation in LACIE — Great Plains corridor, United States
N80-15459
The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE
N80-15482
LACIE area, yield, and production estimate characteristics: U.S. Great Plains
N80-15484
Accuracy and performance of LACIE area estimates — wheat yield in the U.S. Great Plains States
N80-15487
GREENLAND
VLF/LF reflectivity of the polar ionosphere, 23 April - 2 September 1978
[AD-A074762] N80-15318
GROUND TESTS
A simplified ground vibration test procedure for sailplanes and light aircraft
N80-15146
The minimum cost approach to flutter clearance
N80-15148
GROUND TRUTH
Ancillary data acquisition for LACIE
N80-15462
Heat Capacity Mapping Mission [HCMM]
[E80-10039] N80-15513
Obtaining timely crop area estimates using ground-gathered and LANDSAT data
[PB-300825/7] N80-15549
GROUND WIND
A preliminary analysis of mesoscale effects of topography on tropical cyclone-associated surface winds
[AD-A074812] N80-15783
GUIDANCE [MOTION]
Technical evaluation report on the 28th Guidance and Control Panel Symposium on Advances in Guidance and Control Systems Using Digital Techniques
[AGARD-AR-148] N80-15140
GULF OF MEXICO
Surface circulation in the northwestern Gulf of Mexico as deduced from drift bottles
[PB-299078/6] N80-15776
GUNN DIODES
Indium phosphide Gunn devices [26-60GHz]
[AD-A074549] N80-15330
GUNS [ORDNANCE]
Preliminary study of a recoil mechanism using Coulomb friction — for large bore cannon
[AD-A074203] N80-15414

H

HADRONS
Deformed shapes of hadrons
[COO-3069-T1] N80-15882
HAIL
Field observations of kinematics of hailstones
[PB-301387/7] N80-15767
Techniques employed in the processing of particle size spectra and state parameter data obtained with the T-28 aircraft platform
[PB-299362/4] N80-15771
HAILSTORMS
Field observations of kinematics of hailstones
[PB-301387/7] N80-15767
HALIDES
Investigation of plasma processes in electronic transition lasers
[AD-A074892] N80-15394
HANDBOOKS
Manned Orbital Transfer Vehicle [MOTV]. Volume 2: Mission handbook
[NASA-CR-160430] N80-15187
HANDICAPS
A research agenda on science and technology for the handicapped
[PB-301220/5] N80-16005
HARDNESS
Fleet hardness variation — to determine aircraft survivability due to blast loads
[AD-A074849] N80-15029
HARDNESS TESTS
Fleet hardness variation — to determine aircraft survivability due to blast loads
[AD-A074849] N80-15029
HARMONIC EXCITATION
Particle dynamics in ion linear accelerator (penning in double frequency regime
[LA-TR-79-19] N80-15900
HARTREE APPROXIMATION
Multiconfiguration Hartree-Fock method for atomic energy levels and transition probabilities
[COO-4264-3] N80-15884
HAWAII
Solar/wind handbook for Hawaii: Technical applications for Hawaii, the Pacific Basin and sites worldwide with similar climatic conditions
[UCRL-15053] N80-15628
HAZE
An analysis of atmospheric visibility data in the Houston area
[PB-299633/8] N80-15680
Statistical analysis of the source-receptor relationships for ozone and haze in the Houston area
[PB-299634/6] N80-15696
Considerations in the optical characterization of the atmosphere — meteorological parameters and optical properties of fog and haze
[AD-A073480] N80-15747
HEALTH PHYSICS
Environmental development plan photovoltaics
[DOE/EDP-0031] N80-15663
HEART
Activity of cholinesterases of blood and heart in rats of different sex and age during muscular loads and hypokinesia
[NASA-TM-75951] N80-15781
HEAT CAPACITY MAPPING MISSION
Topographical characteristics through the study of the thermal and hydrological dissuniformity of the soil

from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
[E80-10020] N80-15447
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10025] N80-15527
Geological and geothermal data use investigations for application explorer mission-A, heat capacity mapping mission
[E80-10031] N80-15528
Geologic application of thermal inertia imaging using HCMM data — Cuprite, Elko, and Gollfield test areas, Nevada
[E80-10035] N80-15529
HCMM/soil moisture experiment — Alberta, Canada
[E80-10037] N80-15531
Heat Capacity Mapping Mission [HCMM]
[E80-10020] N80-15533
HEAT EXCHANGERS
Corrosion protection of solar-collector heat exchangers with electrochemically deposited films
[COO-4297-1] N80-15569
HEAT FLUX
The effect of inaccuracies in meteorological parameters on one-dimensional forecasts of upper ocean thermal structure
[AD-A073539] N80-15748
HEAT OF COMBUSTION
Sintered silicon nitride recuperator fabrication
[NASA-CR-159706] N80-15263
HEAT PUMPS
New heat transfer geometry for hydride heat engines and heat pumps
[LA-7822] N80-15289
Heat pump centered integrated community energy systems: Systems development
[ANL/ICES-TM-30] N80-15588
Heat pump centered integrated community energy systems; System development
[ANL/ICES-TM-26] N80-15589
Analytical modeling of heat pump units as a design aid and for performance prediction
[UCRL-52618] N80-15610
Intermediate report on the performance of plate-type ice-maker heat pumps
[ORNL/CON-23] N80-15619
HEAT RESISTANT ALLOYS
Effect of sodium, potassium, magnesium, calcium, and chlorine on the high temperature corrosion of IN-100, U-700, IN-792, and Mar M-509 — coal-derived liquid fuel combustion in turbines
[NASA-TM-79309] N80-15235
HEAT SOURCES
Aerodynamic heating on a multi-hundred watt heat source based on wind tunnel tests — for thermal simulation of reentry effects
[AD-A074312] N80-15056
Melting in phase-change thermal storage media
[COO-2993-1] N80-15584
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program
[LA-7990-PR] N80-15902
HEAT STORAGE
Candidate thermal energy storage technologies for solar industrial process heat applications
[NASA-TM-81380] N80-15560
Low temperature thermal energy storage: A state-of-the-art survey
[SERI/RR-54-164] N80-15583
Melting in phase-change thermal storage media
[COO-2993-1] N80-15584
Stability considerations and a double-diffusive convection model for solar ponds
[ANL-CT-79-34] N80-15587
Aquifer thermal energy storage
[LBL-7070] N80-15618
HEAT TOLERANCE
Thermal environment — physiological basis for temperature tolerance limits N80-15791
HEAT TRANSFER
Impact of new instrumentation on advanced turbine research
[NASA-TM-79301] N80-15133
Combustion noise
[NASA-CR-162571] N80-15215
New heat transfer geometry for hydride heat engines and heat pumps
[LA-7822] N80-15289
Multiple jet impingement heat transfer characteristic: Experimental investigation of in-line and staggered arrays with crossflow
[NASA-CR-3217] N80-15360
Full-coverage film cooling on flat, isothermal surfaces: Data and predictions
[NASA-CR-3219] N80-15363
Numerical procedure for calculating steady/unsteady, single-phase/two-phase three-dimensional fluid flow with heat transfer
[NUREG-CR-0782] N80-15376
Comparison of predicted and experimental performance of large-bore roller bearing operating to 3.0 million DN
[NASA-TP-1599] N80-15410
Heat transfer studies in salt and granite
[ORNL/ENG/TM-14] N80-15581
Thermal model of a thermal battery
[SAND-79-0834] N80-15607
HEAT TREATMENT
Design of duplex low-carbon steels with carbide forming elements
[LBL-8628] N80-15244
HEATING
District space heating potential of low temperature hydrothermal geothermal resources in the southwestern United States — using computerized simulation
[NMEI-10-1] N80-15582
HEATING EQUIPMENT
Intermediate report on the performance of plate-type ice-maker heat pumps
[ORNL/CON-23] N80-15619
HEAVY IONS
Heavy ion collisions at relativistic energies
[LBL-6494] N80-15888
Prospects for high energy heavy ion accelerators
[LBL-8999] N80-15898
HELICOPTER PERFORMANCE
Computer program to prepare airfoil characteristic data for use in helicopter performance calculations
[NASA-TM-78627] N80-15031
Effects of primary rotor parameters on flapping dynamics
[NASA-TP-1431] N80-15138
HELICOPTERS
Application of the SIRS concept to Navy helicopters — systems analysis of flight data recorders of flight conditions of helicopters for structural analysis
[AD-A074801] N80-15030
A summary and evaluation of semi-empirical methods for the prediction of helicopter rotor noise
[NASA-TM-80200] N80-15675
HELIUM
Potential laser action in the He-metal vapor mixtures
[AD-A074594] N80-15393
HELMHOLTZ EQUATIONS
Numerical methods for Helmholtz type equations in unbounded regions
[BNL-26543] N80-15858
HEMISPHERICAL SHELLS
Analytical solutions for open nonshallow spherical shell vibrations
[AD-A074269] N80-15434
HEMODYNAMICS
Changes of some blood indices and myocardial electrolyte content during hypokinesia
[NASA-TM-75954] N80-15798
HF LASERS
High energy Optical Resonance Transfer Laser study. Volume 1: Laboratory experiments
[AD-A074126] N80-15399
HIGH ASPECT RATIO
A flutter-speed formula for wings of high aspect ratio N80-15147
HIGH CURRENT
High current testing of lightning arrestor connectors
[SAND-74-0326] N80-15347
HIGH ENERGY INTERACTIONS
Heavy ion collisions at relativistic energies
[LBL-9494] N80-15888
Bilocal field theory and a model for meson spectroscopy, part 1. Trident production by high energy charged particles on nuclei, part 2
[IS-T-861] N80-15889
HIGH ENERGY PROPELLANTS
Advanced oxygen-hydrocarbon rocket engine study
[NASA-CR-161350] N80-15203
HIGH PRESSURE
Evaluation of granular bed filters for high-temperature/high-pressure particulate control — pollution control
[PB-299195/8] N80-15672
HIGH PRESSURE OXYGEN
LOX/GOX mechanical impact tester assessment
[NASA-TM-74106] N80-15179
HIGH RESOLUTION
Data acquisition and reduction for a high-resolution field ionization mass spectrometer
[PB-299936/5] N80-15388
HIGH SPEED
Comparison of predicted and experimental performance of large-bore roller bearing operating to 3.0 million DN
[NASA-TP-1599] N80-15410
Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks N80-15479
Emissions characteristics of six high-speed diesel engines — for use in underground mines
[BETC/TPR-78/7] N80-15667
HIGH STRENGTH ALLOYS
Aging behavior of alloy 800H and associated mechanical property changes — for nuclear reactors
[GA-A-15194] N80-15251
Corrosion of several alloys in superheated steam at 482 and 538 deg centigrade
[ORNL/TM-6465] N80-15252
HIGH STRENGTH STEELS
Design of duplex low-carbon steels with carbide forming elements
[LBL-8628] N80-15244
HIGH TEMPERATURE
High temperature electrolysis — synthetic fuel production
[BNL-26331] N80-15227
Evaluation of granular bed filters for high-temperature/high-pressure particulate control — pollution control
[PB-299195/8] N80-15672
HIGH TEMPERATURE LUBRICANTS
High temperature lubricants and oils, volume 2. Citations from the Engineering Index data base
[NTIS/PS-79/1032/6] N80-15276
HIGH TEMPERATURE RESEARCH
Unified creep-plasticity model for structural metals at high temperature
[ORNL/TM-5969] N80-15440
HIGH TEMPERATURE TESTS
Filament winding epoxy resins for elevated temperature service
[UCRL-52577] N80-15212
HIGH VOLTAGES
Assessment of research directions for high voltage direct current power systems — using a high voltage direct current circuit breaker
[COO-5014-9] N80-15348
HIGHWAYS
Pavement evaluation and overlay design: A symposium and related papers
[PB-299896/1] N80-15305
Experimental evaluation of a portable energy absorbing system for highway service vehicles
[PB-299168/5] N80-15419
HILBERT SPACE
Ergodic theorems for nonlinear contraction semigroups in a Hilbert space
[ANL-79-50] N80-15860
HISTORIES
AFFDL experience in active control technology N80-15159
Intensive archeological survey of a potential independent spent fuel storage facility, Savannah River Plant, Aiken and Barnwell Counties, South Carolina, research manuscript series 141
[DOE/SR-01072-1] N80-15914
Toward the endless frontier: History of the Committee on Science and Technology 1959 - 1979
[GPO-35-120] N80-15994
HOMOGENEITY
Regularity of solutions to an inhomogeneous differential equation in Banach space
[CONF-7906102-1] N80-15862
HORMONES
Biochemical indices of stress: Biochemical aspects of the stress response N80-15812
HORN ANTENNAS
Horn antennas. Citations from the International Aerospace Abstracts data base
[NTIS/PS-79/1018/5] N80-15326
HOT CORROSION
Theory of deposition of condensible impurities on surfaces immersed in combustion gases
[NASA-CR-159716] N80-15130
Experimental studies of the formation/deposition of sodium sulfate in/from combustion gases — hot corrosion of gas turbine engine components
[NASA-CR-159753] N80-15131
An investigation of the initiation stage of hot corrosion in Ni-base alloys
[NASA-CR-159718] N80-15233
Effect of sodium, potassium, magnesium, calcium, and chlorine on the high temperature corrosion of IN-100, U-700, IN-792, and Mar M-509 — coal-derived liquid fuel combustion in turbines
[NASA-TM-79309] N80-15235
HOT ELECTRONS
Optically induced hot electron effects in semiconductors
[AD-A073920] N80-15952
HOUSTON [TX]
Captive air bag design study — The relationship between oxidant concentrations in air and precursor levels
[PB-299636/1] N80-15673
The Beryllium-7 program of the Houston area oxidants study
[PB-299632/0] N80-15678
Socio-economic impact analysis of selected air pollution controls in the Houston-Galveston region
[PB-299635/3] N80-15679
An analysis of atmospheric visibility data in the Houston area
[PB-299633/8] N80-15680
Statistical analysis of the source-receptor relationships for ozone and haze in the Houston area
[PB-299634/6] N80-15696
Airborne aeroallergen measurements in Houston, Texas
[PB-299643/7] N80-15697
HUGONIOT EQUATION OF STATE
Hugoniot elastic limits and compression parameters for brittle materials
[UCRL-83020] N80-15437
Physics of mantle and core minerals
[E80-10038] N80-15532
HULLS [STRUCTURES]
The inertia coefficients of an airship in a frictionless fluid
[NACA-164] N80-15042

HUMAN BEINGS
Circadian and circannual rhythms in healthy adults
N80-15807

HUMAN FACTORS ENGINEERING
NASA technical advances in aircraft occupant safety — clear air turbulence detectors, fire resistant materials, and crashworthiness
[NASA-TM-80851] N80-15060
Daytime visual acuity of observers through a window with and without binoculars
[AD-A074722] N80-15800
Some human factors issues in the development and evaluation of cockpit alerting and warning systems
[NASA-RP-1055] N80-15821
Aspects of computer control from the human engineering standpoint
[SLAC-PUB-2307] N80-15831
International activities: The fiscal year 1978 survey of international programs at NEL
[PB-300491/6] N80-16004

HUMAN PERFORMANCE
Circadian rhythms of human performance and resistance: Operational aspects
N80-15808
Sleep disturbance and performance
N80-15814
Circadian rhythms in air operations
N80-15816
Hypnotics and the management of disturbed sleep
N80-15818

HUMAN REACTIONS
Biological rhythms of man living in isolation from time cues
N80-15813

HUMAN TOLERANCES
The physiological basis for spacecraft environmental limits
[NASA-RP-1045] N80-15788
Atmosphere — physiological basis for spacecraft pressure tolerance limits
N80-15789
Sound and noise — in spacecraft
N80-15793
Radiofrequency radiation — spacecraft environmental limits
N80-15794

HUMIDITY
The effect of inaccuracies in meteorological parameters on one-dimensional forecasts of upper ocean thermal structure
[AD-A073539] N80-15748

HUMIDITY MEASUREMENT
The 19701A GSRS, missile number 022, round number B-21, 5 Jul. 1979 — weather and meteorological data
[AD-A073391] N80-15739

HYDRAULIC FLUIDS
High temperature lubricants and oils, volume 2. Citations from the Engineering Index data base
[NTIS/PS-79/1032/6] N80-15274

HYDROCARBON FUEL PRODUCTION
Conversion of cellulosic and waste polymer material to gasoline
[COO-2982-38] N80-15291

HYDROCARBON FUELS
Ethanol/gasoline blends as automotive fuels
[CONF-790520-5] N80-15280

HYDROCARBONS
Correlation and estimation of hydrocarbon vapour-liquid equilibrium constants and application in the calculation of dew- and bubble points of multicomponent mixtures
[PB-300477/7] N80-15230
Houston area oxidant study detailed hydrocarbon analyses
[PB-299629/6] N80-15674
Petrochemicals: Their economic significance in the domestic economy
[PB-299733/6] N80-15992

HYDRODYNAMICS
Classical aerodynamic theory
[NASA-RP-1050] N80-15033
Applications of modern hydrodynamics to aeronautics. Part 1: Fundamental concepts and the most important theorems. Part 2: Applications
[NACA-116] N80-15034
Pressure distribution on Joukowski wings
[NACA-TM-336] N80-15036

HYDROELECTRIC POWER STATIONS
Turbomachinery options for an underground pumped hydroelectric storage plant
[CONF-790803-50] N80-15629
Energy program at the Johns Hopkins University Applied Physics Laboratory
[PB-310245/7] N80-15648

HYDROFLUORIC ACID
Studies of HnFn oligomeric species
[AD-A074177] N80-15268

HYDROFOIL OSCILLATIONS
Leading edge flutter of a supercavitating hydrofoil
[AD-A074636] N80-15301

HYDROGEN
Analysis of hydrogen in solids — technology assessment of ways to analyze hydrogen for hydrogen based energy and hydrogen production
[DOE/ER-0026] N80-15220
Hydrogen scattering cross section, 1H[a,a]1H
[LA-7899-MS] N80-15958

HYDROGEN EMBRITTLEMENT
Environmental hydrogen cracking of HY steel weld metals
[AD-A074104] N80-15237

HYDROGEN ENGINES
New heat transfer geometry for hydride heat engines and heat pumps
[LA-7822] N80-15289

HYDROGEN ISOTOPES
Cryogenic hydrogen data pertinent to magnetic fusion energy
[UCRL-52626] N80-15292

HYDROGEN OXYGEN ENGINES
Liquid oxygen/liquid hydrogen auxiliary power system thruster investigation
[NASA-CR-159674] N80-15202

HYDROGEN PRODUCTION
Analysis of hydrogen in solids — technology assessment of ways to analyze hydrogen for hydrogen based energy and hydrogen production
[DOE/ER-0026] N80-15220
Hydrogen and methane syntheses through radiation catalysis
[COO-4258-1] N80-15284
Fusion energy for hydrogen production — systems engineering of a process for hydrogen production from nuclear fusion
[BNL-24906] N80-15897

HYDROGEN SULFIDE
Environmental overview of geothermal development: The Geysers-Calistoga KGRA. Volume 1: Issues and recommendations
[UCRL-52496-VOL-1] N80-15626

HYDROGEN-BASED ENERGY
Analysis of hydrogen in solids — technology assessment of ways to analyze hydrogen for hydrogen based energy and hydrogen production
[DOE/ER-0026] N80-15220

HYDROGRAPHY
Technical papers on airborne laser hydrography
[PB-299321/0] N80-15546
Surface circulation in the northwestern Gulf of Mexico as deduced from drift bottles
[PB-299078/6] N80-15776

HYDROLOGY
Topographical characteristics through the study of the thermal and hydrological dissuniformity of the soil from the mesoscale. An appplication to local forecasting of ambient temperature from the TELLUS project
[E80-10020] N80-15447
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] N80-15527
Quantity and quality of urban runoff from three localities in the Denver metropolitan area, Colorado
[PB-299859/9] N80-15698

HYDROXYL EMISSION
Interpretation of NO and OH emission from 1976 airborne measurements
[AD-A073898] N80-15661

HYPERSONIC AIRCRAFT
Loading tests of a wing structure for a hypersonic aircraft
[NASA-TP-1596] N80-15068

HYPERSONIC VEHICLES
Hypersonic cruise aircraft propulsion integration study, volume 1
[NASA-CR-158926-VOL-1] N80-15074
Hypersonic cruise aircraft propulsion integration study, volume 2
[NASA-CR-158926-VOL-2] N80-15075

HYPERSPACES
General least-squares fitting procedures to minimize the volume of a hyperellipsoid — linear accelerators
[LA-UR-79-2330] N80-15855

HYPOKINESIA
Influence of hypokinesis on physiological functions in fowl
[NASA-TM-75999] N80-15778
Rat reaction to hypokinesia after prior adaptation to hypoxia
[NASA-TM-75964] N80-15782
Study on the neuronal circuits implicated in postural tremor and hypokinesia
[NASA-TM-76004] N80-15783
Joint Soviet-American experiment on hypokinesia: Experimental results
[NASA-TM-76013] N80-15796
Changes of some blood indices and myocardial electrolyte content during hypokinesia
[NASA-TM-75954] N80-15798
Mechanism of disorder of plastic processes in tissue during prolonged hypokinesia
[NASA-TM-75955] N80-15799

HYPOXIA
Rat reaction to hypokinesia after prior adaptation to hypoxia
[NASA-TM-75964] N80-15782

I

ICE FORMATION
Intermediate report on the performance of plate-type ice-maker heat pumps
[ORNL/CON-23] N80-15619

ICE NUCLEI
Ice nuclei measurements from solid rocket motor effluents
N80-15653

ICEBERGS
Possible methods for distinguishing icebergs from ships by aerial remote sensing
[NASA-TM-79310] N80-15538

IDAHO
Applicability of a generic monitoring program for radioactive waste burial grounds at Oak Ridge National Laboratory and Idaho National Engineering Laboratory
[ORNL/SUB-7167-1] N80-15895

IGNITION
Simple computations for near-optimum ascent and short maneuver targets and desirbit ignition time
[NASA-TM-80850] N80-15185

IGNITION TEMPERATURE
Test equipment for use in determining classifications of combustible dusts
[PB-300615/2] N80-15231

ILLINOIS
Performance evaluation of the existing three lagoon wastewater treatment plant at Pawnee, Illinois
[PB-299740/1] N80-16006

IMAGE INTENSIFIERS
Software techniques for the acquisition of optical data from a minicomputer-based image-intensifier-vidicon system
[AD-A074844] N80-15838

IMAGE PROCESSING
The application of image processing to the detection of corrosion by radiography
[ARL/MAT-REPT-109] N80-15421
LACIE registration processing
N80-15456
Acquisition and preprocessing of LANDSAT data
N80-15461
LACIE data-handling techniques
N80-15463
The classification and measurtion subsystem — wheat
N80-15465
Concepts leading to the IMAGE-100 hybrid interactive system
N80-15466
USDA analyst review of the LACIE IMAGE-100 hybrid system test
N80-15467
Cartography: LACIE's spatial processor
N80-15474
The LACIE data bases: Design considerations
N80-15475
Considerations for design of future research and development interactive image analysis systems
N80-15478
Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks
N80-15479
Cost and performance characteristics of data system configurations for processing remotely sensed data
N80-15481
On the clustering of multidimensional pictorial data
N80-15493
Compensation for atmospheric effects in LANDSAT data
N80-15498
Colorimetric consideration of transparencies for a typical LACIE scene
N80-15506
Generation of uniform chromaticity scale imagery from LANDSAT data
N80-15507
Concept development of automated image analysis. Automated contour recognition and classification in aerial photography by means of angles and curvature
[AD-A074439] N80-15540
Problems in processing multizonal video information at specialized complexes
[NASA-TM-75919] N80-15837
Restoration of speckle images
[AD-A074626] N80-15920

IMAGES
Visual accomodation responses in a virtual image environment
[AD-A074415] N80-15082

IMAGING TECHNIQUES
Image and numerical display aids for manual interpretation
N80-15508
Acoustically scanned optical imaging devices
[AD-A074954] N80-15915
Acoustic microscopy at cryogenic temperatures
[AD-A074502] N80-15919
Imaging of surfaces and defects of crystals — scanning transmission electron microscopy and diffraction patterns
[COO-2995-3] N80-15962
Imaging X-ray spectrometer to study solar activity in conjunction with the SCADM program
[LA-UR-79-1921] N80-16019

IMMUNOLOGY
The course of experimental staphylococcus infection in albino mice during action of certain factors of space flight
[NASA-TM-75973] N80-15779

IMPACT DAMAGE
Soil analyses and evaluations at the impact dynamics research facility for two full-scale aircraft crash tests
[NASA-CR-159199] N80-15299
IMPACT LOADS
Electrical activity in shock-loaded polymers
[SAND-79-0502C] N80-15270
IMPACT RESISTANCE
NASA technical advances in aircraft occupant safety -- clear air turbulence detectors, fire resistant materials, and crashworthiness
[NASA-TM-80851] N80-15060
Physical forces generating acceleration, vibration, and impact -- physiological effects
N80-15792
IMPACT TESTING MACHINES
LOX/GOX mechanical impact tester assessment
[NASA-TM-74106] N80-15179
IMPACT TESTS
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program
[LA-7980-PR] N80-15902
IMPERIAL VALLEY [CA]
Identification of environmental control technologies for geothermal development in the Imperial Valley of California
[UCRL-52548] N80-15668
IMPLOSIONS
Development of imploding liner systems for the NRL LINUS program
[AD-A075005] N80-15926
IMPURITIES
Effect of sodium, potassium, magnesium, calcium, and chlorine on the high temperature corrosion of IN-100, U-700, IN-792, and Mar M-509 -- coal-derived liquid fuel combustion in turbines
[NASA-TM-79309] N80-15235
Modifications in optoelectronic behavior of plasma-deposited amorphous semiconductor alloys via impurity incorporation
[BNL-26646] N80-15255
Local electronic properties of dilute magnetic alloys
[SAN-0034-T4] N80-15966
IN-FLIGHT MONITORING
In-flight measured characteristics of combined flap-spoiler direct lift controls
N80-15165
INCOMPRESSIBLE FLOW
Classical aerodynamic theory
[NASA-RP-1050] N80-15033
INCOMPRESSIBLE FLUIDS
Flow and drag formulas for simple quadrics -- pressure drag and flow equations for an ellipsoid in incompressible fluids
[NACA-253] N80-15043
INDICATING INSTRUMENTS
Limitations of thermocouples in temperature measurements
[CONF-790505-14] N80-15383
INDIUM PHOSPHIDES
Indium phosphide Gunn devices [26-60GHz]
[AD-A074549] N80-15330
INDONESIA
Satellite television in Indonesia
[PB-299524/9] N80-15328
INDUSTRIAL ENERGY
Candidate thermal energy storage technologies for solar industrial process heat applications
[NASA-TM-81301] N80-15560
SERAPH implementation plans
[SERI/RR-34-152] N80-15570
The 1985, 1990 and 1995 midterm energy market model results under three scenarios of Fuel Use Act regulations
[DOE/EIA-0182/2] N80-15592
INDUSTRIAL PLANTS
Meteorological effects of oil refinery operations in Los Angeles
[PB-300720/0] N80-15758
INDUSTRIAL WASTES
Energy conservation through point source recycle with high temperature hyperfiltration -- textile industry
[PB-299183/4] N80-15688
Inventory of resources with emissions greater than 100 tons/year subject to organic material regulations in metropolitan Boston AQCR
[PB-298679/8] N80-15692
INELASTIC COLLISIONS
Angular momentum and the collective modes excited in deep-inelastic processes and in fission
[LBL-9173] N80-15904
INELASTIC SCATTERING
Quark structure functions of mesons, fragmentation functions, higher-twist effects in QCD, deep inelastic scattering, and the Drell-Yan process
[SLAC-PUB-2362] N80-15883
INERTIA
The inertia coefficients of an airship in a frictionless fluid
[NACA-166] N80-15042
INFECTIOUS DISEASES
The course of experimental staphylococcus infection in albino mice during action of certain factors of space flight
[NASA-TM-75973] N80-15779
INFERENCE
Extended likelihood inference in reliability
[LA-7517-MS] N80-15426
INFORMATION DISSEMINATION
The acquisition, storage, and dissemination of LANDSAT and other LACIE support data
N80-15464
US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain
[PB-297691/8] N80-15547
NASA publications
[NASA-TM-80852] N80-15980
NTIS: Concept of the clearinghouse, 1945 - 1979
[PB-300947/9] N80-15991
INFORMATION MANAGEMENT
Data base design for a worldwide multicrop information system
N80-15522
A structural model for database systems
[AD-A074077] N80-15945
Information management problems relating to numeric data base services for DOE
[DOE/TIC-10144] N80-15989
NTIS: Concept of the clearinghouse, 1945 - 1979
[PB-300947/9] N80-15991
Improving the scientific and technical information available to the Environmental Protection Agency in its decision making process
[PB-300580/6] N80-16003
INFORMATION RETRIEVAL
Inverted file facility: User's guide
[AD-A074081] N80-15982
Aerodynamic data base users guide
[AD-A074448] N80-15983
Indexation over large data bases
[AD-A074075] N80-15987
On-line information retrieval systems, volume 2: A bibliography with abstracts
[NTIS/PS-79/0971/6] N80-15990
INFORMATION SYSTEMS
Economic evaluation: Concepts, selected studies, system costs, and a proposed program
N80-15490
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 -- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] N80-15526
Performance and timeliness in a database
[AD-A074552] N80-15826
Study of message text formats: Bibliographic search queries -- computer networks for libraries and information services
[ISSN-0160-9742] N80-15981
Development of a quality assurance methodology for the technical information generation subsystem of NTIPS
[AD-A074299] N80-15984
On-line information retrieval systems, volume 2: A bibliography with abstracts
[NTIS/PS-79/0971/6] N80-15990
NTIS: Concept of the clearinghouse, 1945 - 1979
[PB-300947/9] N80-15991
INFORMATION THEORY
Restoration of speckle images
[AD-A074626] N80-15920
INFRARED DETECTORS
Evaluation of hand-held infrared thermometers for wall thermal resistance determinations
[PB-298057/1] N80-15387
Advanced methods for preparation and characterization of infrared detector materials -- crystallization and phase diagrams of Hg sub 1-x Cd sub x Te
[NASA-CR-161352] N80-15948
INFRARED IMAGERY
Ancillary data acquisition for LACIE
N80-15462
Use of thermal infrared and colour infrared imagery to detect crop moisture stress -- Alberta, Canada
[E80-10036] N80-15530
INFRARED LASERS
Advanced excitation techniques for tunable infrared lasers
[AD-A074732] N80-15390
INFRARED RADIATION
Determination of optical constants for powdered materials in the 10 micron infrared region
[AD-A074465] N80-15918
Effect of infrared radiation on compaction of municipile wastewater sludges
[PB-298296/5] N80-15998
INFRARED REFLECTION
The vegetative index number and crop identification
N80-15503
INFRARED SCANNERS
Pressure Modulator Radiometer [PMR] tests
[NASA-CR-159175] N80-15380
An atmospheric temperature profile measured with an in-situ infrared radiometer
[AD-A074471] N80-15713
INFRARED SPECTRA
Interpretation of NO and OH emission from 1976 airborne measurements
[AD-A073898] N80-15661
INFRARED SPECTROSCOPY
Studies of HeFn oligomeric species
[AD-A074177] N80-15268
INJECTION
Monte Carlo simulation of neutral-beam injection for mirror fusion reactors
[COO-2218-133] N80-15932
INLET FLOW
Calculation of two-dimensional inlet flow fields in a supersonic free stream by an implicit marching code with nonorthogonal mesh generation: User's manual
[NASA-CR-3222] N80-15046
An analytical and experimental study of a short s-shaped subsonic diffuser of a supersonic inlet
[NASA-TM-81406] N80-15134
INORGANIC NITRATES
Western energy sulfate/nitrate monitoring network
[PB-299238/6] N80-15685
INSECTS
Response of selected plant and insect species to simulated SRM exhaust mixtures and to exhaust components from SRM fuels
N80-15657
INSOLATION
Application of Monte Carlo techniques to insolation characterization and prediction
[SERI/RR-36-306] N80-15579
INSOMNIA
Sleep disturbances in humans
N80-15810
INSPECTION
Compliance status of major air pollution facilities
[PB-299959/7] N80-15780
INSULATORS
Displacement characteristics of a glass-ceramic insulator in a vacuum tube envelope sealing process
[GEPP-TIS-6451] N80-15260
INTAKE SYSTEMS
Review of water intake screening options for coastal water users with recommendations for Ocean Thermal Energy Conversion [OTEC] plants
[ANL/OTEC-BCM-005] N80-15572
INTEGRAL EQUATIONS
Methods for numerical conformal mapping
[LA-7836-MS] N80-15857
Finite element method for the solution of a potential theory integral equation
[LBL-9504] N80-15859
INTEGRATED CIRCUITS
Research on low temperature, directed energy processing of very large scale integrated structures
[AD-A074127] N80-15340
Symbolic priority queues
[AD-A074494] N80-15852
INTEGRATED ENERGY SYSTEMS
Heat pump centered integrated community energy systems: Systems development
[ANL/ICES-TM-30] N80-15588
Heat pump centered integrated community energy systems: System development
[ANL/ICES-TM-26] N80-15589
INTERMETALLICS
High-strength aluminum-magnesium alloys: Thermomechanical processing, microstructure and tensile mechanical properties
[AD-A074135] N80-15238
INTERNAL COMBUSTION ENGINES
Investigation of the viability and cost effectiveness of solid fuel gasifiers close coupled to internal combustion engines for 200 kWe power generation
[DOE/RL-80476-13] N80-15293
Free-piston Stirling engine demonstration test plan
[COO-2764-T3] N80-15567
INTERNATIONAL COOPERATION
International space activities, 1979
[GPO-53-451] N80-15184
INVERTED CONVERTERS [DC TO AC]
Analysis of the multiphase inductor-converter bridge -- for the superconductive equilibrium field coils of the tokamak reactors and superconductive magnets used in particle accelerators
[CONF-790622-26] N80-15350
INVISCID FLOW
A numerical viscous-inviscid interaction algorithm for prediction of near-field VSTOL jet-induced flowfields
[AD-A074070] N80-15370
IODINE
Radiation chemistry of hydrocarbon and alkyl halide systems -- deactivation of excited atomic iodine
[ORO-3106-71] N80-15222
ION ACCELERATORS
Prospects for high energy heavy ion acceleration
[LBL-8999] N80-15898
Particle dynamics in ion linear accelerator operating in double frequency regime
[LA-TR-79-19] N80-15900
ION ATOM INTERACTIONS
Fast numerical calculations of ion-atom collisions
[CONF-7905111-1] N80-15880
ION BEAMS
A reflex triode with geometric focussing
[AD-A074453] N80-15341
Heavy ion collisions at relativistic energies
[LBL-9094] N80-15849
ION CHARGE
Electron impact ionization of multicharged ions
[ORNL/TM-7020] N80-15879

ION CURRENTS
Activation volumes of some superionic conductors with the fluorite structure
[COO-1198-1264] N80-15349
ION SCATTERING
Some features of Rayleigh scattering from light atoms and ions
[UCRL-15046] N80-15886
IONIC COLLISIONS
Fast numerical calculations of ion-atom collisions
[CONF-7905111-1] N80-15880
Heavy ion collisions at relativistic energies
[LBL-9494] N80-15888
IONIZATION CROSS SECTIONS
Electron impact ionization of multicharged ions
[ORNL/TM-7020] N80-15879
Fast numerical calculations of ion-atom collisions
[CONF-7905111-1] N80-15880
IONIZING RADIATION
Study of electronic transport and breakdown in thin insulating films
[AD-A074457] N80-15342
IONOSPHERE
The investigation of man-made modifications of the ionosphere — effects of detonations and rocket exhaust
[NASA-CR-162579] N80-15707
A global ionospheric model
[AD-A074370] N80-15709
IONOSPHERIC DRIFT
Temporal and spatial power spectrum studies of numerical simulations of type 2 gradient drift irregularities in the equatorial electrojet
[AD-A073467] N80-15716
IONOSPHERIC PROPAGATION
VLF/LF reflectivity of the polar ionosphere, 23 April - 2 September 1978
[AD-A074762] N80-15318
Airborne all-sky imaging of equatorial airglow
[AD-A073716] N80-15717
IRON
Adhesion and friction of iron-base binary alloys in contact with silicon carbide in vacuum
[NASA-TP-1604] N80-15234
Effect of point defects on mechanical properties of metals
[COO-1367-97] N80-15245
Production of iron by direct reduction
[PB-300533/7] N80-15262
IRON ALLOYS
Electrical and optical properties of high purity p-type single crystals of GeFe2O4
[AD-A073998] N80-15949
IRON COMPOUNDS
Development of Li-Al/FeS cells with LiCl-rich electrolyte
[CONF-7810135-2] N80-15614
IRRADIANCE
Global calibration of terrestrial reference cells and errors involved in using different irradiance monitoring techniques
[NASA-TM-81393] N80-15561
IRRADIATION
Hydrogen and methane syntheses through radiation catalysis
[COO-4258-1] N80-15284
Pathogen reduction in sludges by irradiation
[SAND-78-1957C] N80-15996
ITALY
Topographical characteristics through the study of the thermal and hydrological dissuniformity of the soil from the mesoscale. An appplication to local forecasting of ambient temperature from the TELLUS project
[E80-10020] N80-15447
ITERATIVE SOLUTION
Iterative metric method for solving the inverse Tokamak equilibrium problem — for plasma control using the magnetohydrodynamic equilibrium equation
[PPPL-1564] N80-15941

J

JET AIRCRAFT NOISE
Quiet Clean Short-haul Experimental Engine [QCSEE] Over-The-Wing [OTW] propulsion systems test report. Volume 4: Acoustic performance
[NASA-CR-135326] N80-15118
An experimental study of the structure and acoustic field of a jet in a cross stream — Ames 7-ft by 10-ft wind tunnel tests
[NASA-CR-162464] N80-15871
JET ENGINES
Computer simulation of engine systems
[NASA-TM-79290] N80-15132
JET IMPINGEMENT
Multiple jet impingement heat transfer characteristic: Experimental investigation of in-line and staggered arrays with crossflow
[NASA-CR-3217] N80-15360
Computer program for generating input for analysis of impingement-cooled, axial-flow turbine blade
[NASA-TP-1603] N80-15361
JET STREAMS [METEOROLOGY]
Clear air turbulence. A bibliography with abstracts
[NTIS/PS-79/0972/4] N80-15752
JOUKOWSKI TRANSFORMATION
Pressure distribution on Joukowski wings
[NACA-TM-336] N80-15036
Graphic construction of Joukowski wings
[NACA-TM-336] N80-15037

K

KEVLAR [TRADEMARK]
Moisture sorption and diffusion in Kevlar 49 aramid fiber
[AD-A074547] N80-15266
KINEMATICS
Influence of geometric and kinematic factors on combustion performance
[TAE-350] N80-15214
Field observations of kinematics of hailstones
[PB-301387/7] N80-15767
KINETIC THEORY
Elements of the wing section theory and of the wing theory
[NACA-191] N80-15040
KINETICS
Theory of chemical kinetics — franck-condon approximation
[COO-2873-3] N80-15223
KUTTA-JOUKOWSKI CONDITION
Behavior of vortex systems — kutta-joukowski condition for vortices over lifting surfaces
N80-15045

L

LABORATORY EQUIPMENT
Mass and emissions spectrometry in the Analytical Chemistry Division of Oak Ridge National Laboratory
[ORNL/TM-6485] N80-15226
LAGOONS
Waste stabilization lagoon microorganism removal efficiency and effluent disinfection with chlorine
[PB-300631/9] N80-15786
Performance evaluation of the existing three lagoon wastewater treatment plant at Pawnee, Illinois
[PB-299740/1] N80-16006
LAMINAR BOUNDARY LAYER
Separation jump and sudden stall over an ellipsoidal wind at incidence — wing flow method tests for investigating laminar boundary layer, boundary layer transition, and separated flow
[AD-A074260] N80-15054
LAMINAR FLOW
The mechanism of fluid resistance
N80-15035
LAMINAR FLOW AIRFOILS
A parametric wing design study for a modern laminar flow wing
[NASA-TM-80154] N80-15050
LAMINATES
Steady-state point-source excitation of a laminated composite
[AD-A074336] N80-15207
Classical analyses of laminated bimodulus composite-material plates
[AD-A074125] N80-15208
Fatigue failure of composite laminates — graphite-epoxy composite materials
[AD-A073899] N80-15209
LAND MANAGEMENT
Mission analysis for the Federal fuels from biomass program. Volume 3: Feedstock availability
[SAN-0115-T1] N80-15276
Federal leasing and outer continental shelf energy production goals
[DOE/RA-0037] N80-15640
LAND USE
Ancillary data acquisition for LACIE
N80-15462
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] N80-15526
Analysis of potential implementation levels for waste heat utilization in the nuclear power industry
[ORNL/TM-63-2] N80-15625
LANDSAT SATELLITES
Acquisition and preprocessing of LANDSAT data
N80-15461
LARGE AREA CROP INVENTORY EXPERIMENT
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
Sampling, aggregation, and variance estimation for area, yield, and production in LACIE
N80-15449
Econometric models for predicting confusion crop ratios
N80-15450
LACIE sampling design
N80-15451
LACIE area sampling frame and sample selection
N80-15452
LACIE large area acreage estimation — United States of America
N80-15453
Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts — wheat
N80-15454
Classification and measurement of LACIE segments
N80-15455
LACIE registration processing
N80-15456
Development of LACIE CCEA-1 weather/wheat yield models — regression analysis
N80-15457
Growth stage estimation — crop calendars
N80-15458
Accuracy assessment: The statistical approach to performance evaluation in LACIE — Great Plains corridor, United States
N80-15459
Manual interpretation of LANDSAT data
N80-15460
Acquisition and preprocessing of LANDSAT data
N80-15461
Ancillary data acquisition for LACIE
N80-15462
LACIE data-handling techniques
N80-15463
The acquisition, storage, and dissemination of LANDSAT and other LACIE support data
N80-15464
The classification and measurement subsystem — wheat
N80-15465
Concepts leading to the IMAGE-100 hybrid interactive system
N80-15466
USDA analyst review of the LACIE IMAGE-100 hybrid system test
N80-15467
Operation of the yield estimation subsystem
N80-15468
The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports
N80-15469
LACIE status and tracking
N80-15470
LACIE quality assurance
N80-15471
Accuracy assessment system and operation
N80-15472
LACIE applications evaluation system efficiency report
N80-15473
Cartography: LACIE's spatial processor
N80-15474
The LACIE data bases: Design considerations
N80-15475
Man-machine interfaces in LACIE/ERIPS
N80-15476
LACIE/ERIPS software system summary
N80-15477
Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks
N80-15479
A look at computer system selection criteria
N80-15480
Cost and performance characteristics of data system configurations for processing remotely sensed data
N80-15481
The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE
N80-15482
Application of LANDSAT digital data for monitoring drought — South Dakota
N80-15483
LACIE area, yield, and production estimate characteristics: U.S. Great Plains
N80-15484
LACIE area, yield, and production estimate characteristics: U.S.S.R.
N80-15485
LACIE area, yield, and production estimate characteristics: Canada
N80-15486
Accuracy and performance of LACIE area estimates — wheat yield in the U.S. Great Plains States
N80-15487
Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world
N80-15488
Accuracy and performance of LACIE crop development models
N80-15489
Economic evaluation: Concepts, selected studies, system costs, and a proposed program
N80-15490
Methods for segment wheat area estimation
N80-15491
Estimating crop proportions from remotely sensed data
N80-15492
On evaluating clustering procedures for use in classification
N80-15494
CLASSY: An adaptive maximum likelihood clustering algorithm
N80-15495
Linear feature selection with applications
N80-15496

Compensation for atmospheric effects in LANDSAT data
N80-15498

Development of partitioning as an aid to spectral signature extension
N80-15499

Methods of extending crop signatures from one area to another
N80-15500

Signature extension methods in crop area estimation
N80-15501

An evaluation of procedure 1
N80-15502

The vegetative index number and crop identification
N80-15503

Manual LANDSAT data analysis for crop type identification
N80-15504

LACIE analyst interpretation keys
N80-15505

Colorimetric consideration of transparencies for a typical LACIE scene
N80-15506

Generation of uniform chromaticity scale imagery from LANDSAT data
N80-15507

Image and numerical display aids for manual interpretation
N80-15508

A programmed labeling approach to image interpretation
N80-15509

Status of yield estimation technology: A review of second-generation model development and evaluation
N80-15510

A universal model for estimating wheat yields [CONTRIB-79-266-A]
N80-15511

The law of the minimum and an application to wheat yield estimation
N80-15512

CCEA second-generation wheat yield model for hard red wheat in North Dakota
N80-15513

Prediction of wheat phenological development: A state-of-the-art review
N80-15514

New developments in sampling and aggregation for remotely sensed surveys
N80-15515

Natural sampling strategy
N80-15516

Multiyear estimates for the LACIE sampling plans
N80-15517

Weighted aggregation
N80-15518

Design, implementation, and results of LACIE field research
N80-15519

The application test system: An approach to technology transfer — USDA aerospace and remote sensing information requirements
N80-15520

Functional definition and design of a USDA system
N80-15521

Data base design for a worldwide multicrop information system
N80-15522

The application test system: Technical approach and system design
N80-15523

Resource modeling: A reality for program cost analysis
N80-15524

The application test system: Experiences to date and future plans
N80-15525

Analysis of scanner data for crop inventories — North Dakota [E80-10040]
N80-15534

Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7]
N80-15549

LARGE SCALE INTEGRATION

Research on low temperature, directed energy processing of very large scale integrated structures [AD-A074127]
N80-15340

LARGE SPACE STRUCTURES

Space construction base control system [NASA-CR-161353]
N80-15194

Control systems design for large flexible space structures [NASA-CR-162582]
N80-15201

LASER APPLICATIONS

Principles, calibration and process experience for a new laser aerosol detector system [BNL-25018]
N80-15403

Laser welding. Citations from the Engineering Index data base — bibliography with abstracts [NTIS/PS-79/1028/4]
N80-15418

Technical papers on airborne laser hydrography [PB-299321/0]
N80-15546

Near and long term pulse power requirements for laser driven inertial confinement fusion [UCRL-82661]
N80-15938

LASER CAVITIES

A simple model for calculating the index of refraction of neon I and neon [3S] in the cavity of a xenon fluoride laser [AD-A074380]
N80-15392

Laser intracavity modulation and stabilization [AD-A074679]
N80-15395

LASER FUSION

Overvoltage protection by point-plane spark gaps [LA-UR-79-3655]
N80-15345

Micro-fresnel structures for microscopy of laser generated bright X-ray sources [UCRL-82666]
N80-15401

Compact 5 x 10-12 AMP/SEC rail-gun pulser for a laser plasma shutter [UCRL-82536]
N80-15407

Research on the HYLIFE liquid-first-wall concept for future laser fusion reactors [UCRL-15035]
N80-15930

Near and long term pulse power requirements for laser driven inertial confinement fusion [UCRL-82661]
N80-15938

LASER HEATING

Electric characteristics of ion-implanted laser-annealed silicon [CONF-780932-4]
N80-15352

LASER OUTPUTS

Tripling of CO2 laser radiation in DBr, DCl and Se [COO-4253-7]
N80-15406

Applying a compensated pulsed alternator to a flashlamp load for NOVA [UCRL-82475]
N80-15408

LASER PLASMA INTERACTIONS

Investigation of plasma processes in electronic transition lasers [AD-A074892]
N80-15394

LASER PUMPING

Optically induced hot electron effects in semiconductors [AD-A073920]
N80-15952

LASER RANGE FINDERS

Precise relative location estimation from satellite laser observations — Geos 3 satellite [NASA-CR-159953]
N80-15536

LASER TARGETS

Characteristics of thick non-planar SiO2 coatings — surface finishing laser fusion targets [UCRL-81842]
N80-15213

LASERS

Light communication systems, volume 3. A bibliography with abstracts [NTIS/PS-79/0998/9]
N80-15327

Development of a high-voltage linear actuator amplifier system [AD-A074266]
N80-15343

Potential laser action in the He-metal vapor mixtures [AD-A074994]
N80-15393

Applying a compensated pulsed alternator to a flashlamp load for NOVA [UCRL-82475]
N80-15408

Atmospheric effects on laser beams, volume 2. A bibliography with abstracts [NTIS/PS-79/0981/5]
N80-15409

LATE STARS

Lyman alpha initiated winds in late-type stars [NASA-CR-162467]
N80-16008

LATERAL CONTROL

Some wind tunnel measurements of the effectiveness at low speeds of combined lift and roll controls
N80-15153

Roll control by digitally controlled segment spoilers
N80-15156

Flaperon control: The versatile surface for fighter aircraft
N80-15158

LEAD [METAL]

Evaluation of stationary source particulate measurement methods. Volume 5: Secondary lead smelters [PB-300337/3]
N80-15701

LEADING EDGES

Leading edge flutter of a supercavitating hydrofoil [AD-A074636]
N80-15301

LEAST SQUARES METHOD

Multiyear estimates for the LACIE sampling plans
N80-15517

General least-squares fitting procedures to minimize the volume of a hyperellipsoid — linear accelerators [LA-UR-79-2330]
N80-15855

Numerical rank determination in linear least squares problems [SAND-79-8243]
N80-15861

LEGENDRE FUNCTIONS

Analytical solutions for open nonshallow spherical shell vibrations [AD-A074269]
N80-15434

LIBRARIES

Study of message text formats. Bibliographic search queries — computer networks for libraries and information services [ISSN-0160-9742]
N80-15981

LIE GROUPS

Integrability conditions for the existence of a Lagrangian in Newtonian mechanics and field theory — Pauli's exclusion principle [COO-4742-1]
N80-15972

LIFT

Some wind tunnel measurements of the effectiveness at low speeds of combined lift and roll controls
N80-15153

LIFT DEVICES

Behavior of vortex systems — kutta-joukowski condition for vortices over lifting surfaces
N80-15045

LIFTING BODIES

Behavior of vortex systems — kutta-joukowski condition for vortices over lifting surfaces
N80-15045

LIGHT [VISIBLE RADIATION]

Spectral, far-field, and near-field measurements of five light-emitting diodes [AD-A074517]
N80-15339

LIGHT AIRCRAFT

Low cost aircraft flutter clearance — conference [AGARD-CP-278]
N80-15141

Comparison of international flutter requirements and flutter freedom substantiation of light aircraft in the USA
N80-15142

The state-of-the-art of flutter substantiation procedures among US general aviation manufacturers
N80-15143

An empirical approach for checking flutter stability of gliders and light aircraft
N80-15144

Dynamic identification of light aircraft structures and their flutter certification
N80-15145

A simplified ground vibration test procedure for sailplanes and light aircraft
N80-15146

The minimum cost approach to flutter clearance
N80-15148

LIGHT EMITTING DIODES

Spectral, far-field, and near-field measurements of five light-emitting diodes [AD-A074517]
N80-15339

LIGHT MODULATION

Laser intracavity modulation and stabilization [AD-A074679]
N80-15395

LIGHT SCATTERING

Principles, calibration and process experience for a new laser aerosol detector system [BNL-25018]
N80-15403

Some features of Rayleigh scattering from light atoms and ions [UCRL-15046]
N80-15486

Statistics of optical radiation scattered from rough surfaces [AD-A074351]
N80-15917

Measurement of polarized light scattering via the Mueller matrix [AD-A074431]
N80-15922

Method of normalizing the measured scattered light from a surface defect located arbitrarily in a Gaussian intensity distribution incident on a surface [BDX-613-2287]
N80-15957

LIGHT TRANSMISSION

Atmospheric effects on laser beams, volume 2. A bibliography with abstracts [NTIS/PS-79/0981/5]
N80-15409

LIGHT WATER BREEDER REACTORS

Analytical models and experimental studies of centrifugal-pump performances in two-phase flow — light water reactor coolant pumps [EPRI-NP-677]
N80-15415

LIGHTNING

Storm research [PB-300299/5]
N80-15760

LIGHTNING SUPPRESSION

High current testing of lightning arrestor connectors [SAND-78-0326]
N80-15347

LINE SHAPE

Auger lineshape analysis of molecules and solids [SAND-79-1240C]
N80-15956

LINEAR ACCELERATORS

General least-squares fitting procedures to minimize the volume of a hyperellipsoid — linear accelerators [LA-UR-79-2330]
N80-15855

Particle dynamics in ion linear accelerator operating in double frequency regime [LA-TR-79-19]
N80-15900

Calculation of quadripolar focusing of a linear accelerator and of beam adaptation in the presence of a space charge [LA-TR-79-18]
N80-15901

LINEAR AMPLIFIERS

Development of a high-voltage linear actuator amplifier system [AD-A074266]
N80-15343

LINEAR PROGRAMMING

Research and evaluation of biomass resources/conversion/utilization systems [market/experimental analysis for development of a data base for a fuels from biomass model]
[COO-5022-5]
N80-15576

MARKAL: A multiperiod linear-programming model for energy systems analysis [BNL version]
[BNL-26390]
N80-15634

Linear multiple objective problems with interval coefficients
[AD-A073967]
N80-15975

LINEARITY
Linear feature selection with applications
N80-15486
Characterization of acoustic disturbances in linearly sheared flows
[NASA-CR-162577] N80-15869
LININGS
Development of imploding liner systems for the NRL LINUS program
[AD-A075005] N80-15926
LIQUEFIED NATURAL GAS
LNG industry: An overview of projects and costs
[CONF-7811112-2] N80-15278
Simulation of LNG vapor spread and dispersion by finite element methods
[UCRL-82441] N80-15282
LIQUID HELIUM
Forced two phase helium cooling of large superconducting magnets
[LBL-9701] N80-15373
LIQUID HYDROGEN
Liquid oxygen/liquid hydrogen auxiliary power system thruster investigation
[NASA-CR-159674] N80-15202
LIQUID OXYGEN
LOX/GOX mechanical impact tester assessment
[NASA-TM-74106] N80-15179
Liquid oxygen/liquid hydrogen auxiliary power system thruster investigation
[NASA-CR-159674] N80-15202
Advanced oxygen-hydrocarbon rocket engine study
[NASA-CR-161350] N80-15203
Evaluation of worn SSME low pressure liquid oxygen turbopump bearing
[NASA-CR-161367] N80-15412
LIQUID PHASES
Liquid phase epitaxial growth of gallium arsenide
[AR-001-468] N80-15947
LIQUID SURFACES
Vacuum ultraviolet electronic properties of liquids
[ORO-3861-28] N80-15217
LIQUID-LIQUID INTERFACES
Liquid-liquid contact in vapor explosion
[ANL/RAS-78-37] N80-15285
LIQUID-SOLID INTERFACES
On the multiple scattering of waves from obstacles with solid-fluid interfaces
[AD-A074057] N80-15433
LIQUID-VAPOR EQUILIBRIUM
Correlation and estimation of hydrocarbon vapour-liquid equilibrium constants and application in the calculation of dew- and bubble points of multicomponent mixtures
[PB-300477/7] N80-15230
LIQUID-VAPOR INTERFACES
Two-phase vapour-liquid flow with phase change, review
[PB-299905] N80-15379
Response characteristics of optical probes — for liquid-vapor interfaces
[BNL-NUREG-24479] N80-15385
LITHIUM
Long-term lithium battery tests
[SAND-79-0487] N80-15608
LITHIUM CHLORIDES
Development of Li-Al/FeS cells with LiCl-rich electrolyte
[CONF-7810135-2] N80-15614
LITHIUM HYDRIDES
New heat transfer geometry for hydride heat engines and heat pumps
[LA-7822] N80-15289
LITHIUM SULFUR BATTERIES
Lithium/iron sulfide batteries for electric vehicles
[CONF-781006-2] N80-15611
LITHOLOGY
Geologic application of thermal inertia imaging using HCMM data — Cuprite, Elko, and Golfield test areas, Nevada
[E80-10035] N80-15529
LOAD TESTS
Loading tests of a wing structure for a hypersonic aircraft
[NASA-TP-1596] N80-15068
LOADS [FORCES]
Linear and nonlinear symmetrically loaded shells of revolution approximated with the finite element method
[LA-7538-MS] N80-15439
LOGIC
Analysis techniques for multivariate root loci — a tool in linear control systems
[NASA-CR-162570] N80-15853
LOGIC DESIGN
Programming language design. A bibliography with abstracts
[NTIS/PS-79/0979/9] N80-15850
LOGISTICS MANAGEMENT
Manned Orbital Transfer Vehicle [MOTV]. Volume 5: Turnaround analysis
[NASA-CR-160433] N80-15190
LOOP ANTENNAS
Experimental loop antennas for 60 KHz to 200 KHz
[NASA-CR-162729] N80-15063
LORAN
Loran digital phase-locked loop and RF front-end system error analysis
[NASA-CR-162731] N80-15065
LORAN C
Experimental loop antennas for 60 KHz to 200 KHz
[NASA-CR-162729] N80-15063
Data reduction software for LORAN-C flight test evaluation
[NASA-CR-162730] N80-15064
The effects of primary power transmission lines on the performance of LORAN-C receivers in experimental terrestrial applications
[PB-301367/9] N80-15066
LOW COST
The minimum cost approach to flutter clearance
N80-15148
LOW NOISE
Indium phosphide Gunn devices [26-60GHz]
[AD-A074549] N80-15330
LOW PASS FILTERS
Restoration of speckle images
[AD-A074626] N80-15920
LOW PRESSURE
Turbine cycle performance improvement through titanium LP blades
[EPRI-AF-905] N80-15417
LOW SPEED
Some wind tunnel measurements of the effectiveness at low speeds of combined lift and roll controls
N80-15153
Unsteady aerodynamics of two-dimensional spoilers at low speeds
N80-15170
LOW TEMPERATURE
Low temperature electron irradiation and annealing of pure cadmium
[COO-1198-1274] N80-15246
Low temperature reaction path for coal liquefaction
[SAND-79-0738C] N80-15288
Research on low temperature, directed energy processing of very large scale integrated structures
[AD-A074127] N80-15340
Low temperature thermal energy storage: A state-of-the-art survey
[SERI/RR-54-564] N80-15583
LOW TEMPERATURE PHYSICS
Acoustic microscopy at cryogenic temperatures
[AD-A074502] N80-15919
LUBRICANTS
The physical and chemical characterization of ten military turbine engine lubricants
[AD-A074073] N80-15265
LUBRICATING OILS
High temperature lubricants and oils, volume 2. Citations from the Engineering Index data base
[NTIS/PS-79/1032/6] N80-15274
Measurements and standards for recycled oil - 2
[PB-299951/4] N80-15275
LUBRICATION SYSTEMS
Comparison of predicted and experimental performance of large-bore roller bearing operating to 3.0 million DN
[NASA-TP-1599] N80-15410
LUNAR COMPOSITION
Crystallization, flow and thermal histories of lunar and terrestrial compositions
[NASA-CR-162445] N80-16013
LUNAR CRUST
Velocity model of the shallow lunar crust
[NASA-CR-162573] N80-16014
LUNAR GEOLOGY
Handbook of lunar materials
[NASA-RP-1057] N80-16009
Geochemistry of lunar and planetary processes
[NASA-CR-162583] N80-16015
LYMAN ALPHA RADIATION
Lyman alpha initiated winds in late-type stars
[NASA-CR-162467] N80-16008

M

MAGNESIUM ALLOYS
High-strength aluminum-magnesium alloys: Thermomechanical processing, microstructure and tensile mechanical properties
[AD-A074185] N80-15238
MAGNETIC COILS
General Dynamics Convair Division approach to structural analysis of large superconducting coils
[UCRL-13975] N80-15357
MAGNETIC FIELDS
Stimulated emission by relativistic electrons traversing a periodic magnetic field
[AD-A073888] N80-15396
MAGNETIC FLUX
PULSAR: An inductive pulse power source
[SAND-79-1246C] N80-15627
MAGNETIC INDUCTION
Analysis of the multiphase inductor-converter bridge — for the superconductive equilibrium field coils of the tokamak reactors and superconductive magnets used in particle accelerators
[CONF-790622-26] N80-15350
MAGNETIC MATERIALS
Local electronic properties of dilute magnetic alloys
[SAN-0034-T4] N80-15966
MAGNETIC MIRRORS
Monte Carlo simulation of neutral-beam injection for mirror fusion reactors
[COO-2218-133] N80-15932
Stochastic motion of particles in mirror machines
[UCRL-82481] N80-15944
MAGNETIC STORAGE
LACIE data-handling techniques
N80-15463
MAGNETOHYDRODYNAMIC STABILITY
Equilibrium and stability in strongly inhomogeneous plasmas
[LBL-8528] N80-15929
Iterative metric method for solving the inverse Tokamak equilibrium problem — for plasma control using the magnetohydrodynamic equilibrium equation
[PPPL-1564] N80-15941
Two-stream instability for a scattered beam propagating in a collisional plasma
[LA-UR-79-1687] N80-15945
MAGNETOHYDRODYNAMIC TURBULENCE
Statistical theory of Langmuir turbulence
[LA-UR-79-576] N80-15940
MAGNETOHYDRODYNAMICS
Technical support for open-cycle MHD program — project planning and systems analysis of a magnetohydrodynamic/steam power system
[ANL/MHD-79-11] N80-15942
MAGNETOSPHERE
Birkeland currents and ring currents in the computer simulation of the substorm of 19 September 1976
[AD-A073852] N80-15712
MAINTENANCE
Experimental evaluation of a portable energy absorbing system for highway service vehicles
[PB-299166/5] N80-15419
Effects of inspection and maintenance programs on fuel economy
[PB-297583/7] N80-15420
MAN ENVIRONMENT INTERACTIONS
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] N80-15526
Man's effect on stratospheric ozone
[UCRL-82556] N80-15666
The investigation of man-made modifications of the ionosphere — effects of detonations and rocket exhaust
[NASA-CR-162579] N80-15707
MAN MACHINE SYSTEMS
Man-machine interfaces in LACIE/ERIPS
N80-15476
Considerations for design of future research and development interactive image analysis systems
N80-15478
Signature extension methods in crop area estimation
N80-15501
Model task for the dynamics of an underwater two-legged walker
[NASA-TM-75697] N80-15822
Man-machine communication in computer-aided remote manipulation
[AD-A074566] N80-15823
Teleoperators under the sea
[PB-299883/9] N80-15824
Decision making and problem solving with computer assistance
[NASA-TM-76008] N80-15973
MANAGEMENT
Research and Technology Objectives and Plans Summary [RTOPS]. Research and Technology program, fiscal year 1980
[NASA-TM-80744] N80-15974
MANAGEMENT INFORMATION SYSTEMS
Interactive Environmental Impact Computer System [EICS] user manual
[AD-A074890] N80-15662
Preliminary design of a network virtual data base system
[AD-A074205] N80-15986
MANAGEMENT METHODS
Tunable lasers for waste management photochemistry applications
[LA-7113-MS] N80-15402
LACIE quality assurance
N80-15471
Resource modeling: A reality for program cost analysis
N80-15524
Management by objectives. A bibliography with abstracts
[NTIS/PS-79/0958/3] N80-15976
Scheduling of flexible flowshops [systems aspects of flexible manufacturing systems]
[PB-301218/4] N80-15979
Information management problems relating to numeric data base services for DOE
[DOE/TIC-10144] N80-15989
MANAGEMENT PLANNING
Environmental planning and assessment for highway vehicle use to alcohol fuels
[CONF-790520-2] N80-15281
The application test system: Experiences to date and future plans
N80-15525

MANGANESE ALLOYS
Effects of air melting on Fe/9.1/3Cr/0.5Mo/2Mn and Fe/9.3C/3Cr/0.5Mo/2Ni structural alloy steels [LBL-16867] N80-15347
MANIPULATORS
Man-machine communication in computer-aided remote manipulation [AD-A074566] N80-15823
MANNED SPACE FLIGHT
Manned Orbital Transfer Vehicle [MOTV]. Volume 4: Supporting analysis [NASA-CR-160432] N80-15189
Manned Orbital Transfer Vehicle [MOTV]. Volume 5: Turnaround analysis [NASA-CR-160433] N80-15190
Results of medical studies during long-term manned flights on the orbital Salyut-6 and Soyuz complex [NASA-TM-76014] N80-15797
MANNED SPACECRAFT
Manned geosynchronous mission requirements and systems analysis study. Volume 1: Executive summary [NASA-CR-160429] N80-15186
Manned Orbital Transfer Vehicle [MOTV]. Volume 2: Mission handbook [NASA-CR-160430] N80-15187
Manned Orbital Transfer Vehicle [MOTV]. Volume 3: Program requirements documents [NASA-CR-160431] N80-15188
Manned Orbital Transfer Vehicle [MOTV]. Volume 6: Five year program plan [NASA-CR-160434] N80-15191
MANUFACTURING
The state-of-the-art of flutter substantiation procedures among US general aviation manufacturers N80-15143
A survey of photovoltaic systems [NASA-CR-150896] N80-15563
Scheduling of flexible flowshops [systems aspects of flexible manufacturing systems] [PB-300218/4] N80-15979
MAPPING
Cartography: LACIE's spatial processor N80-15474
Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data [NASA-TP-1555] N80-15535
MARINE ENVIRONMENTS
American-Soviet Symposium on Chemical Pollution of the Marine Environment, Int [PB-298343/5] N80-15683
International Decade of Ocean Exploration, volume 7 — information on oceanography programs dealing with marine environments [NOAA-S/T-78-211-VOL-7] N80-15772
MARINE METEOROLOGY
Modeling the refractive index structure parameter in the marine planetary boundary layer [AD-A074275] N80-15710
Woods Hole Oceanographic Institution Collection of Climatology and Air/Sea Interaction [CASI] data [AD-A075809] N80-15729
Refinement of a statistical diagnostic model of marine fog using FNWC model output parameters [AD-A075959] N80-15730
TWINDIX: A planetary boundary layer model for the winds in extratropical and tropical ocean areas [AD-A074337] N80-15732
Summary of Synoptic Meteorological Observations [SSMO]. Selected South Pacific island marine areas, volume 2. Area 9: Isle Wallis. Area 10: Samoa Islands. *Area 11: New Caledonia. Area 12: New Hebrides Islands.* Area 13: Fiji Islands. Area 14: Tonga Islands. Area 15: Niue Island. Area 16: Rarotonga Island [lower Cook Islands] [AD-A073446] N80-15745
Summary of Synoptic Meteorological Observations [SSMO]. Selected South Pacific island marine areas, volume 1. Area 1: Nauru Island and Ocean Island. *Area 2: Gilbert Islands. Area 3: Canton and Phoenix Islands.* Area 4: Christmas and Jarvis Islands. Area 5: Solomon Islands, Northeast. Area 6: Solomon Islands, Southwest. Area 7: Funafuti Atoll. Area 8: Marquesas Islands [AD-A073445] N80-15746
A model of diurnal variability of the ocean-atmosphere system in the undisturbed trade wind regime [AD-A073540] N80-15749
MARKET RESEARCH
Minerals in the US economy: Ten-year supply-demand profiles for nonfuel mineral commodities [1968-77] [PB-299536/3] N80-15548
Application analysis of solar total energy systems to the residential sector. Volume 4: Market penetration [ALO-3787-4] N80-15597
MARYLAND
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — *Pennsylvania, Delaware, Maryland,* Virginia, and the District of Columbia [E80-10031] N80-15526
MASERS
Analytic analysis of linear growth rates of gyrotron for TElm modes with zero-temperature beam electrons [AD-A074368] N80-15397
MASS FLOW RATE
Performance evaluation of a drag-disc turbine transducer and three-beam gamma densitometer under transient two-phase flow conditions [CONF-790623-15] N80-15384
MASS SPECTROMETERS
Data acquisition and reduction for a high-resolution *field ionization mass spectrometer* [PB-299936/5] N80-15388
MASS SPECTROSCOPY
Single-stage mass spectrometric analyses of resin bead samples [ORNL/TM-6563] N80-15224
Mass and emission spectrometry in the Analytical Chemistry Division of Oak Ridge National Laboratory [ORNL/TM-6485] N80-15226
Geochemistry of lunar and planetary processes [NASA-CR-162583] N80-16015
MATERIALS HANDLING
Single-stage mass spectrometric analyses of resin bead samples [ORNL/TM-6563] N80-15224
Proceedings of the Hydride Storage Reservoir Symposium/Workshop [BNL-26522] N80-15286
MATERIALS RECOVERY
Technical barriers to the *reuse of aluminum recovered from municipal refuse* [PB-300436/3] N80-15261
Meteorological effects of oil refinery operations in Los Angeles [PB-300720/9] N80-15758
MATERIALS TESTS
The fracture of a parachute hook: A case study of the role of materials parameters in reliability analysis [AR-001-591] N80-15429
MATHEMATICAL MODELS
Pressure distribution on Joukowski wings [NACA-TM-336] N80-15036
A flutter-speed formula for wings of high aspect ratio N80-15147
Continued development of fluid dynamics models [AD-A078848] N80-15367
Development of an alternative to the E9 procedure for predicting boundary-layer transition [AD-A074071] N80-15369
Numerical procedure for calculating steady/unsteady, single-phase/two-phase three-dimensional fluid flow with heat transfer [NUREG-CR-0782] N80-15376
Wave propagation in viscoelastic media [UCRL-83019] N80-15378
Structural modeling of a thick-rim rotor [SAND-78-1941C] N80-15416
Accuracy and performance of LACIE crop development models N80-15489
Status of yield estimation technology: A review of *second-generation model development and evaluation* N80-15510
A universal model for estimating wheat yields [CONTRIB-78-268-A] N80-15511
The law of the minimum and an application to wheat yield estimation N80-15512
CCEA second-generation wheat yield model for *hard red wheat in North Dakota* N80-15513
Prediction of wheat phenological development: A state-of-the-art review N80-15514
Resource modeling: A reality for program cost analysis N80-15524
User's manual for computer code SOLTES-1 [Simulator *Of Large Thermal Energy Systems*] [SAND-78-1315-REV] N80-15575
Research and evaluation of biomass resources/conversion/utilization systems [market/experimental analysis for development of a data base for a fuels from biomass model] [COO-5022-5] N80-15576
Stability considerations and a double-diffusive convection model for solar ponds [ANL-CT-79-34] N80-15587
The 1985, 1990 and 1995 midterm energy market model results under three scenarios of Fuel Use Act regulations [DOE/EIA-0182/2] N80-15592
Fuel utilization in residences [EPRI-EA-894] N80-15604
Thermal model of a thermal battery [SAND-79-0834] N80-15607
MARKAL: A multiperiod linear-programming model for energy systems analysis [BNL version] [BNL-26390] N80-15634
Acid rain: Mesoscale model N80-15655
Acid rain: Microphysical model N80-15656
Analytical diffusion model for long distance transport of air pollutants [PB-299356/2] N80-15675
One-dimensional steady-state stream water-quality model [PB-300327/4] N80-15677
In-stack plume opacity from electrostatic precipitator/scrubber system at Harrington Unit 1 [PB-299215/4] N80-15686
Global crustal response model — using a computer program to mathematically model the Earth tide and its dynamic response [NASA-CR-159055] N80-15705
Numerical modeling of baroclinic instability [NASA-CR-161363] N80-15706
ARMA models for earthquake ground motions — California [UCRL-15084] N80-15719
Chemical Kinetic Data Needs for Modeling the Lower Troposphere [PB-299439/0] N80-15722
Summer fellowship in scientific computing [PB-301297/8] N80-15724
Refinement of a statistical diagnostic model of marine fog using FNWC model output parameters [AD-A075959] N80-15730
TWINDIX: A planetary boundary layer model for the winds in extratropical and tropical ocean areas [AD-A074337] N80-15732
A model of diurnal variability of the ocean-atmosphere system in the undisturbed trade wind regime [AD-A073540] N80-15749
Application of a two-dimensional cloud model to cloud seeding experiments [PB-299997/8] N80-15769
Far-field matching for tidal calculations in near-shore regions [PB-299016/6] N80-15777
Mental dynamics — mathematical description [LA-7946-MS] N80-15820
Data model processing: An approach to standardization of database management systems [AD-A074601] N80-15827
Semi-analytical formulae for real-time implementation of optimal missile avoidance strategies [TAE-352] N80-15834
Studies in astronomical time series analysis: Modeling random processes in the time domain [NASA-TM-81148] N80-15854
Deformed shapes of hadrons [COO-3069-T1] N80-15882
Bilocal field theory and a model for meson spectroscopy, part 1. Trident production by high energy charged particles on nuclei, part 2 [IS-T-861] N80-15889
Relativistic electron beam propagation: Two-stream theory — using a mathematical mode to describe particle motion through a neutral gas [LA-7912-MS] N80-15905
Analysis of the early phase of Tokamak plasma ohmic heating [WFPS-TME-79-018] N80-15927
On 1/N expansions and the phased diagram of *discrete lattice gauge theories with matter fields — Ising* model N80-15968
SCRAP: Theory and modeling considerations [ANL-CT-79-49] N80-15997
MATHEMATICAL PROGRAMMING
SNEX: Semianalytic solution of the one-dimensional discrete ordinates [S/n] transport equations with diamond-differenced angular fluxes [LA-7879-MS] N80-15856
MATRICES [MATHEMATICS]
Numerical rank determination in linear least squares problems [SAND-79-8243] N80-15861
Measurement of polarized light scattering via the Mueller matrix [AD-A074431] N80-15922
MATRIX THEORY
Method of optimal truncation: A new t-matrix approach to elastic wave scattering [LA-UR-79-1954] N80-15324
An in-depth study of the sensitivity of wave digital filters [AD-A073962] N80-15338
MAXIMUM LIKELIHOOD ESTIMATES
Extended likelihood inference in reliability [LA-7517-MS] N80-15426
CLASSY: An adaptive maximum likelihood clustering algorithm N80-15495
Multiyear estimates for the LACIE sampling plan N80-15517
MEASURE AND INTEGRATION
Classification and mensuration of LACIE segments N80-15455
MEASURING INSTRUMENTS
Measurement techniques for solar cells [PB-301309/1] N80-15646
MECHANICAL DEVICES
Investigation of adaptive control for recoil mechanisms [AD-A074024] N80-15951
MECHANICAL PROPERTIES
Characteristics of thick non-planar SiO_2 coatings — *surface finishing laser fusion targets* [UCRL-81842] N80-15213
Effect of nitrogen concentration on temperature dependent mechanical properties of vanadium [IS-M-195] N80-15248
Nitrogen-strengthened austenitic stainless steel for cryogenic magnet structures [CONF-790815-13] N80-15258

The physical and chemical characterization of ten military turbine engine lubricants
[AD-A074073] N80-15265
LLL materials program for fiber-composite flywheels
[UCRL-83043] N80-15632
Handbook of lunar materials
[NASA-RP-1057] N80-16009
MEDITERRANEAN SEA
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] N80-15527
MELTING
Effects of air melting on Fe/0.1/Cr/0.9Mo/2Mn and Fe/0.3C/3Cr/0.5Mo/2Ni structural alloy steels
[LBL-9103] N80-15243
Phase change heat conduction in general orthogonal curvilinear coordinates
[AD-A074896] N80-15969
MELTS (CRYSTAL GROWTH)
Liquid phase epitaxial growth of gallium arsenide
[AR-001-668] N80-15947
MENTAL PERFORMANCE
Mental dynamics — mathematical description
[LA-7946-MS] N80-15820
MERCURY ALLOYS
Advanced methods for preparation and characterization of infrared detector materials — crystallization and phase diagrams of Hg sub 1-x Cd sub x Te
[NASA-CR-161352] N80-15948
MERCURY ARCS
Investigation of plasma processes in electronic transition lasers
[AD-A074892] N80-15394
MERRITT ISLAND [FL]
Ecological baseline studies
N80-15658
MESH
Modifying the GNATS mesh generation code to improve the modeling of branched structures
[C/CSD/TM-26] N80-15444
MESONS
Quark structure functions of mesons, fragmentation functions, higher-twist effects in QCD, deep inelastic scattering, and the Drell-Yan process
[SLAC-PUB-2362] N80-15883
Bilocal field theory and a model for meson spectroscopy. *part 1. Trident production by high energy charged particles on nuclei, part 2*
[IS-T-86] N80-15889
MESOSCALE PHENOMENA
Topographical characteristics through the study of the thermal and hydrological dissimilarity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
[E80-10020] N80-15447
METAL BONDING
Metallographic quality control of welding and brazing
[CONF-790730-1] N80-15425
METAL HYDRIDES
Proceedings of the Hydride Storage Reservoir Symposium/Werkshop
[BNL-26523] N80-15286
METAL MATRIX COMPOSITES
FRS composites for advanced gas turbine engine components
[AD-A074287] N80-15137
Energy absorption mechanisms during crack propagation in metal matrix composites
[NASA-CR-162574] N80-15232
METAL OXIDE SEMICONDUCTORS
Advanced electronic technology
[AD-A074083] N80-15950
METAL SURFACES
Studies of metal-semiconductor interfaces in catalysis and energy conversion
[COO-4946-1] N80-15221
Long-term erosion monitoring of metallic conduits by ultrasonic pulse-echo techniques — components of coal gasification and liquefaction pilot plants
[CONF-790480-1] N80-15259
Back surface reflectors for solar cells
[NASA-TM-81390] N80-15556
METAL VAPORS
Potential laser action in the He-metal vapor mixtures
[AD-A074596] N80-15393
METALLIZING
Gold plating metallized alumina ceramics
[GEPP-TIS-330] N80-15254
METALLOGRAPHY
Nitrogen-strengthened austenitic stainless steel for cryogenic magnet structures
[CONF-790815-13] N80-15258
Metallographic quality control of welding and brazing
[CONF-790730-1] N80-15425
METALLURGY
Tantalum fabrication — microstructural analysis
[UCID-18152] N80-15256
METALS
Stress-intensity factors and crack-opening displacements for round compact specimens — fracture toughness of metallic materials
[NASA-TM-80174] N80-15430
METEOROLOGICAL CHARTS
Moisture advection and the Sangster chart
[AD-A073432] N80-15744
Daily high-latitude 150 mb pressure maps from Twerle [Tropical Wind, reference level and energy conversion experiment] and rawinsondes. Part 1: 16 November 1975 - 31 January 1976
[PB-301343/0] N80-15766
METEOROLOGICAL PARAMETERS
Refinement of a statistical diagnostic model of snow fog using FNWC model output parameters
[AD-A077999] N80-15720
Evaluation of the saturation resistant crosswind sensor
[AD-A074276] N80-15731
Edwards AFB, Lancaster, California, Revised Uniform Summary of Surface Weather Observations [RUSSWO]
[AD-A074691] N80-15734
The 1702A GSRS, missile number 306, round number B-26, 9 July 1979 — weather and meteorological data
[AD-A073394] N80-15736
The 19701A GSRS, missile numbers 304, 305, 307, round numbers B-22, B-23, B-24, 5 July 1979
[AD-A073392] N80-15737
The 19702A GSRS, missile number 321, round number B-25, 9 July 1979 — weather and meteorological data
[AD-A073393] N80-15738
The 19701A GSRS, missile number 022, round number B-21, 5 Jul. 1979 — weather and meteorological data
[AD-A073391] N80-15739
The 148220 Lance, missile number 4390, round number 334-AST — weather and meteorological data
[AD-A073387] N80-15741
The 19304DT GSR, missile numbers 1070 and 1048, round numbers V-47 and V-48, 28 June 1979 — weather and meteorological data
[AD-A073389] N80-15742
The 19304B GSRS, missile numbers 1029, 1050, 1054, 1073, 1074, 1056, round numbers V-49, V-50, V-51, V-52, V-53, V-54, 2 July 1979 — weather and meteorological data
[AD-A073390] N80-15743
Summary of Synoptic Meteorological Observations [SSMO]. Selected South Pacific island marine areas, volume 1. Area 1: Nauru Island and Ocean Island. Area 2: Gilbert Islands. Area 3: Canton and Phoenix Islands. Area 4: Christmas and Jarvis Islands. Area 5: Solomon Islands, Northeast. Area 6: Solomon Islands, Southwest. Area 7: Funafuti Atoll. Area 8: Marquesas Islands
[AD-A073445] N80-15746
Considerations in the optical characterization of the atmosphere — meteorological parameters and optical properties of fog and haze
[AD-A073480] N80-15747
METEOROLOGICAL RADAR
System considerations of a long range coherent lidar wind sensor with particular emphasis on real weather effects
[PB-299972/0] N80-15757
GATE radar CAPPI derivation for three-dimensional reflectivity analyses
[PB-301263/0] N80-15765
METEOROLOGICAL SATELLITES
SESAME [Severe Environmental Storms And Mesoscale Experiment], 1979 plans for operations and data archival — conference
[PB-299878/9] N80-15756
Error characteristics of satellite-derived winds
[PB-300754/9] N80-15759
METEOROLOGY
Atmospheric echo sounding. A bibliography with abstracts
[NTIS/PS-79/0989/8] N80-15721
The 1702A GSRS, missile number 306, round number B-26, 9 July 1979 — weather and meteorological data
[AD-A073394] N80-15736
The 19702A GSRS, missile number 321, round number B-25, 9 July 1979 — weather and meteorological data
[AD-A073393] N80-15738
The 148220 Lance, missile number 4390, round number 334-AST — weather and meteorological data
[AD-A073387] N80-15741
The 19304DT GSR, missile numbers 1070 and 1048, round numbers V-47 and V-48, 28 June 1979 — weather and meteorological data
[AD-A073389] N80-15742
The 19304B GSRS, missile numbers 1029, 1050, 1054, 1073, 1074, 1056, round numbers V-49, V-50, V-51, V-52, V-53, V-54, 2 July 1979 — weather and meteorological data
[AD-A073390] N80-15743
The effect of inaccuracies in meteorological parameters on one-dimensional forecasts of upper ocean thermal structure
[AD-A073539] N80-15748
Solar energy meteorological research and training site, region 5 — project planning for education course in solar radiation and meteorology
[DOE/ET/20172-1] N80-15750
METHANE
Fast production of methane by anaerobic digestion. *Volume 2: Appendices*
[COO-2900-17-VOL-2] N80-15283
Hydrogen and methane syntheses through radiation catalysis
[COO-4258-1] N80-15284
Economic analysis of small scale bioconversion units in New Mexico
[PB-301390/1] N80-15290
MICROCOMPUTERS
Software development system for small dedicated and front-end microcomputer [LSI-11] applications
[CONF-7811112-1] N80-15848
MICROELECTRONICS
Advanced electronic technology
[AD-A074083] N80-15950
MICROFILMS
LACIE data-handling techniques
N80-15463
The acquisition, storage, and dissemination of LANDSAT and other LACIE support data
N80-15464
MICROORGANISMS
Waste stabilization lagoon microorganism removal efficiency and effluent disinfection with chlorine
[PB-300631/9] N80-15786
MICROPROCESSORS
The use of classifiers and microprocessors for target identification on using millimeter wave signatures
[AD-A074840] N80-15317
Distributed, secure design for a multi-microprocessor operating system
[AD-A073923] N80-15828
The design and implementation of an inexpensive microprocessor development system for the Z-80 microprocessor
[AD-A073927] N80-15829
Utility and math subroutines for the M6800 microprocessor
[MLM-2564] N80-15847
Microcomputer-controlled ultrasonic data acquisition system
[ORNL/TM-6531] N80-15877
MICROSCOPES
Acoustic microscopy at cryogenic temperatures
[AD-A074502] N80-15919
MICROSTRIP TRANSMISSION LINES
Ka-band microwave integrated circuit SPDT switch development
[AD-A074602] N80-15335
MICROSTRUCTURE
High-strength aluminum-magnesium alloys: Thermomechanical processing, microstructure and tensile mechanical properties
[AD-A074185] N80-15238
Design of duplex low-carbon steels with carbide forming elements
[LBL-8628] N80-15244
Tantalum fabrication — microstructural analysis
[UCID-18152] N80-15256
Aims and accomplishments of surface theory
[SAND-79-1150C] N80-15964
MICROWAVE AMPLIFIERS
Phased array antenna amplifier exploratory development model
[AD-A074961] N80-15315
Indium phosphide Gunn devices [26-60GHz]
[AD-A074549] N80-15330
Superconducting microwave pulse amplifier
[AD-A074056] N80-15331
Characteristics of exotron oscillation and amplification. 1. Power and frequency characteristics
[AD-A074761] N80-15337
MICROWAVE EQUIPMENT
Ka-band microwave integrated circuit SPDT switch development
[AD-A074602] N80-15335
MICROWAVE SCATTERING
Observation of stimulated Brillouin scattering in a microwave plasma interaction experiment
[PPG-422] N80-15935
MICROWAVE TUBES
Investigation of microwave circuits that are suitable for application to integrate with the *Pirasol-Lolbys'* plasma millimeter wave tube
[AD-A074988] N80-15925
MICROWAVES
Electromagnetic fields in biological media. Part 2: The SCAT program, multilayered sphere, theory and applications
[PB-300904/0] N80-15804
MIE SCATTERING
MIE scattering calculations, advances in technique and fast, vector-shaped computer codes
[PB-301388/5] N80-15923
MILITARY AIRCRAFT
AFFDL experience in active control technology
N80-15159
MILITARY HELICOPTERS
Analysis of low-speed helicopter flight test data
[AD-A074141] N80-15079
MILITARY OPERATIONS
Management of irregular rest and activity
N80-15819
MILITARY TECHNOLOGY
AFFDL experience in active control technology
N80-15159

Control integration technology impact — as a basis for improving the combat effectiveness of all tactical aircraft
N80-15162
An assessment of software quality assurance — to strengthen ballistic missile defense systems command research
[AD-A074213] N80-15843
Additional software developments for the HP-21 MX
[AD-A074068] N80-15846
MILLIMETER WAVES
The use of classifiers and microprocessors for target identification on using millimeter wave signatures
[AD-A074048] N80-15317
Nomograms for the calculation of propagation effects on tactical millimeter wave radio links
[AD-A073900] N80-15322
Investigation of microwave circuits that are suitable for application to integrate with the Fraud-Lebrys' three millimeter wave tube
[AD-A074988] N80-15925
MINERAL DEPOSITS
Minerals in the US economy: Ten-year supply-demand profiles for nonfuel mineral commodities [1968-77]
[PB-299536/3] N80-15548
MINERAL EXPLORATION
Geologic application of thermal inertia imaging using HCMM data — Cuprite, Elko, and Goldfield test areas, Nevada
[E80-10035] N80-15529
MINERALOGY
Physics of mantle and core minerals
[E80-10030] N80-15532
MINERALS
Physics of mantle and core minerals
[E80-10030] N80-15532
MINES [EXCAVATIONS]
Three potential longwall mining methods for thick coal seams in the western United States
[PB-299568/6] N80-15544
Coal mine combustion products identification and analysis: Procedures and summary
[PB-299559/5] N80-15545
Emission characteristics of six high-speed diesel engines — for use in underground mines
[BETC/TPR-79/7] N80-15667
MINICOMPUTERS
VTS processing display subsystem design — to prevent environmental damage in harbor areas
[AD-A074053] N80-15830
Minicomputers, volume 2. A bibliography with abstracts
[NTIS/PS-79/0978/1] N80-15832
Additional software developments for the HP-21 MX
[AD-A074068] N80-15846
Bulletin of the Division of Mechanical Engineering and the National Aeronautical Establishment — design of a gas pipeline station control system and a railway switch car
[AD-A074885] N80-16022
MINIMA
The law of the minimum and an application to wheat yield estimation
N80-15512
MINING
Three potential longwall mining methods for thick coal seams in the western United States
[PB-299568/6] N80-15544
Evaluation of the environmental effects of western surface coal mining, volume 1
[PB-300375/3] N80-15681
MINNESOTA
Diffusion coefficients from Metrac system turbulence measurements
[PB-300339/9] N80-15763
MIRRORS
Mirror quality required by the Antares laser system
[LA-UR-79-2058] N80-15405
MISSILE CONFIGURATIONS
Aerodynamic study of missile control surfaces
N80-15177
MISSILE DEFENSE
An assessment of software quality assurance — to strengthen ballistic missile defense systems command research
[AD-A074213] N80-15843
MISSILE RANGES
The 1970IA GSRS, missile number 022, round number B-21, 5 Jul. 1979 — weather and meteorological data
[AD-A073391] N80-15739
MISSILES
Semi-analytical formulae for real-time implementation of optimal missile avoidance strategies
[TAE-352] N80-15834
A differential dynamic programming algorithm for the solution of the three-dimensional optimal missile avoidance
[TAE-351] N80-15835
MISSION PLANNING
Simple computations for near-optimum escort and short maneuver targets and decrbit ignition time
[NASA-TM-80850] N80-15185
Manned Orbital Transfer Vehicle [MOTV]. Volume 2: Mission handbook
[NASA-CR-160430] N80-15187
Manned Orbital Transfer Vehicle [MOTV]. Volume 4: Supporting analysis
[NASA-CR-160432] N80-15189
Nuclear powered satellite studies
[COO-4045-4] N80-15198
Management of irregular rest and activity
N80-15819
MIXTURES
Correlation and estimation of hydrocarbon vapor-liquid equilibrium constants and application in the calculation of dew- and bubble points of multicomponent mixtures
[PB-300477/7] N80-15230
MODAL RESPONSE
Analysis and tests of the B-1 aircraft structural mode control system
[NASA-CR-144887] N80-15073
MODELS
Model 540 rotor blade crack propagation investigation
[AD-A074734] N80-15081
MOISTURE CONTENT
Analyses of moisture in polymers and composites
[NASA-CR-159745] N80-15264
Precipitable water over the United States. Volume 2: Semimonthly maxima
[PB-300870/3] N80-15753
MOLECULAR ABSORPTION
Quantitative comparison of multiple-photon absorption in polyatomic molecules
[CONF-790690-3] N80-15892
MOLECULAR BIOLOGY
Synchrotron radiation: A new tool for biophysical spectroscopy in the visible and ultraviolet
[BNL-24811] N80-15225
MOLECULAR EXCITATION
Theoretical investigation of the excitation structure and optical properties of titanium, vanadium and their oxides
[AD-A074222] N80-15241
MOLECULAR ORBITALS
Auger lineshape analysis of molecules and solids
[SAND-79-1240C] N80-15956
MOLECULAR RELAXATION
Studies of HnFn oligomeric species
[AD-A074177] N80-15268
MOLECULAR STRUCTURE
Theoretical investigation of the excitation structure and optical properties of titanium, vanadium and their oxides
[AD-A074222] N80-15241
MOLYBDENUM
Fatigue crack propagation in 21/4 Cr-1 Mo steel
[CONF-790802-41] N80-15250
MOMENTUM
Elements of the wing section theory and of the wing theory
[NACA-191] N80-15040
MOMENTUM TRANSFER
Large momentum transfer electron scattering from few-nucleon systems
[SLAC-PUB-2373] N80-15890
MONTANA
Airborne studies of atmospheric aerosol in the High Plains and the structures of natural and artificially seeded clouds in eastern Montana
[PB-299026/5] N80-15770
MONTE CARLO METHOD
Application of Monte Carlo techniques to insolation characterization and prediction
[SERI/RR-36-306] N80-15579
Monte Carlo simulation of neutral-beam injection for mirror fusion reactors
[COO-2218-133] N80-15932
MOON
Handbook of lunar materials
[NASA-RP-1057] N80-16009
MOSSBAUER EFFECT
The crystal structure and variable temperature Sn-119m Mossbauer study of trimethyltin glycinate, a one-dimensional, amino-bridged polymer
[AD-A074383] N80-15955
MOTION SIMULATORS
The effects of motion and g-seat cues on pilot simulator performance of three piloting tasks
[NASA-TP-1601] N80-15069
MOTOR VEHICLES
Environmental planning and assessment for highway vehicle use to alcohol fuels
[CONF-790630-2] N80-15281
Investigation of the effects of the installation of an oxidation catalyst on a diesel powered vehicle
[PB-299928/2] N80-15699
Evaluation of particulate emission factors for vehicle tire wear
[PB-300443/9] N80-15702
MULTICHANNEL COMMUNICATION
Narrowband voice system
[AD-A074445] N80-15314
MULTIPROCESSING [COMPUTERS]
Distributed, secure design for a multi-microprocessor operating system
[AD-A073923] N80-15828
MULTISPECTRAL BAND SCANNERS
Cloud Top Scanning radiometer [CTS]
[NASA-CR-159954] N80-15381
Design, implementation, and results of LACIE field research
N80-15519
Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data
[NASA-TP-1553] N80-15535
MULTISPECTRAL PHOTOGRAPHY
Generation of uniform chromaticity scale imagery from LANDSAT data
N80-15507
Obtaining timely crop area estimates using ground-gathered and LANDSAT data
[PB-300825/7] N80-15549
MULTIVARIATE STATISTICAL ANALYSIS
CLASSY: An adaptive maximum likelihood clustering algorithm
N80-15495
An evaluation of procedure 1
N80-15502

N

N-TYPE SEMICONDUCTORS
Electric characteristics of ion-implanted laser-annealed silicon
[CONF-780932-4] N80-15352
NACELLES
Quiet Clean Short-haul Experimental Engine [QCSEE] preliminary under the wing flight propulsion system analysis report
[NASA-CR-134868] N80-15088
Quiet Clean Short-haul Experimental Engine [QCSEE]. Under The-Wing [UTW] engine boilerplate nacelle test report, volume 1
[NASA-CR-135249] N80-15096
Quiet Clean Short-haul Experimental Engine [QCSEE]. Under-The-Wing [UTW] engine boilerplate nacelle test report. Volume 3: Mechanical performance
[NASA-CR-135251] N80-15097
Quiet Clean Short-haul Experimental Engine [QCSEE] Over-The-Wing [OTW] boilerplate nacelle design report
[NASA-CR-135168] N80-15099
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] composite nacelle subsystem test report — to verify strength of selected composite materials
[NASA-CR-135075] N80-15100
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] boiler plate nacelle and core exhaust nozzle design report
[NASA-CR-135008] N80-15116
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] composite nacelle
[NASA-CR-135352] N80-15119
NASA PROGRAMS
NASA technical advances in aircraft occupant safety — clear air turbulence detectors, fire resistant materials, and crashworthiness
[NASA-TM-80851] N80-15060
Quiet powered-lift propulsion
[NASA-CP-2077] N80-15127
Research and Technology Objectives and Plans Summary [RTOPS]. Research and Technology program, fiscal year 1980
[NASA-TM-80744] N80-15974
NASTRAN
Structural modeling of a thick-rim rotor
[SAND-78-1941C] N80-15416
NATURAL GAS
Commercialization strategy report for recovery of natural gas from unconventional sources
[TID-28948-DRAFT] N80-15287
Bulletin of the Division of Mechanical Engineering and the National Aeronautical Establishment — design of a gas pipeline station control system and a railway switch car
[AD-A074885] N80-16022
NEAR WAKES
Numerical prediction of flows over and in the near wake behind axisymmetric, self-propelled bodies
[AD-A074971] N80-15371
User's guide for a system of computer programs to predict flows over and in the near wake behind axisymmetric, self-propelled bodies
[AD-A074972] N80-15372
NEODYMIUM LASERS
Micro-fresnel structures for microscopy of laser generated bright X-ray sources
[UCRL-82684] N80-15401
NEON
A simple model for calculating the index of refraction of neon I and neon [35] in the cavity of a xenon fluoride laser
[AD-A074380] N80-15392
NEPHANALYSIS
Cloud volume studies — study of rocket exhaust clouds through nephanalysis and cloud physics
N80-15650
NEUROLOGY
Psychostimulants
N80-15817
NEUROMUSCULAR TRANSMISSION
Activity of cholinesterases of blood and heart in rats of different sex and age during muscular loads and hypokinesia
[NASA-TM-75951] N80-15781

Study on the neuronal circuits implicated in postural tremor and hypokinesia
[NASA-TM-76004] N80-15783
NEUROPHYSIOLOGY
Study on the neuronal circuits implicated in postural tremor and hypokinesia
[NASA-TM-76004] N80-15783
Sleep stage organization: Neuro endocrine relations N80-15809
NEUTRAL BEAMS
Diagnostic neutral beams for spectroscopic studies of impurities by charge-transfer reactions
[CONF-790585-2] N80-15887
Monte Carlo simulation of neutral-beam injection for mirror fusion reactors
[COO-2218-133] N80-15932
NEUTRAL GASES
Relativistic electron beam propagation: Two-stream theory — using a mathematical mode to describe particle motion through a neutral gas
[LA-7912-MS] N80-15905
NEUTRAL PARTICLES
Production of neutrinos and neutrino-like particles in proton-nucleus interactions
[SLAC-216] N80-15891
NEUTRINOS
Production of neutrinos and neutrino-like particles in proton-nucleus interactions
[SLAC-216] N80-15891
NEUTRONS
Neutron hardness assurance guidelines for semiconductor devices
[AD-A074882] N80-15951
NEVADA
Geologic application of thermal inertia imaging using HCMM data — Caprite, Elko, and Golfield test areas, Nevada
[E80-10035] N80-15529
Technical concept for a test of geologic storage of spent reactor fuel in the climax granite, Nevada Test Site
[UCRL-52796] N80-15899
NEW MEXICO
Economic analysis of small scale bioconversion units in New Mexico
[PB-301390/1] N80-15298
Use of geothermal energy for desalination in New Mexico: A feasibility study
[PB-299271/7] N80-15645
Northwest New Mexico boundary layer experiment
[LA-7525-MS] N80-15751
NEWTON THEORY
Integrability conditions for the existence of a Lagrangian in Newtonian mechanics and field theory — Pauli's exclusion principle
[COO-4742-1] N80-15972
NICKEL ALLOYS
An investigation of the initiation stage of hot corrosion in Ni-base alloys
[NASA-CR-159716] N80-15233
Effects of air melting on Fe/0.3/3Cr/0.5Mo/2Mn and Fe/0.3C/3Cr10.5Mo/2Ni structural alloy steels
[LBL-9103] N80-15243
NICKEL PLATE
Effect of point defects on mechanical properties of metals
[COO-1367-97] N80-15245
NIKE-TOMAHAWK ROCKET VEHICLE
Active experiments using rocket-borne shaped charge barium releases — solar-terrestrial magnetospheric physics
[NASA-CR-162581] N80-15708
NIMBUS SATELLITES
Survey of satellite sensors and data with application to OTEC resource and operations requirements
[PB-300297/9] N80-15543
NIOBIUM
Effect of point defects on mechanical properties of metals
[COO-1367-97] N80-15245
NIOBIUM STANNIDES
Fermi surface measurements in A-15 compounds
[CONF-790653-13] N80-15960
NITRIC ACID
Treatment of Am 355 steel for adhesive bonding
[AD-A074113] N80-15236
NITROGEN
Effect of nitrogen concentration on temperature dependent mechanical properties of vanadium
[IS-M-195] N80-15248
Nitrogen-strengthened austenitic stainless steel for cryogenic magnet structures
[CONF-790815-13] N80-15258
NITROGEN OXIDES
Study of the nature of ozone, oxides of nitrogen, and nonmethane hydrocarbons in Tulsa, Oklahoma. Volume 1: Project description and data summaries
[PB-300481/9] N80-15229
Interpretation of NO and OH emission from 1976 airborne measurements
[AD-A073898] N80-15661
Pilot scale evaluation of NOx combustion control for pulverized coal, phase 2
[PB-299325/1] N80-15687
NOISE [SOUND]
Combustion noise
[NASA-CR-162571] N80-15215
Sound and noise — in spacecraft N80-15793
NOISE GENERATORS
An experimental study of the structure and acoustic field of a jet in a cross stream — Ames 7-ft by 10-ft wind tunnel tests
[NASA-CR-162466] N80-15871
NOISE MEASUREMENT
Landing approach airframe noise measurements and analysis
[NASA-TP-1602] N80-15028
Quiet Clean Short-haul Experimental Engine [QCSEE] Core engine noise measurements
[NASA-CR-135160] N80-15093
A study of partial coherence for identifying interior noise sources and paths on general aviation aircraft
[NASA-TM-80197] N80-15874
NOISE POLLUTION
Maneuvering aircraft: Noise pollution and control, volume 2. A bibliography with abstracts
[NTIS/PS-79/0975/2] N80-15671
NOISE PROPAGATION
A study of partial coherence for identifying interior noise sources and paths on general aviation aircraft
[NASA-TM-80197] N80-15874
NOISE REDUCTION
Demonstration of short-haul aircraft aft noise reduction techniques on a twenty inch [50.8 cm] diameter fan, volume 1
[NASA-CR-134849] N80-15083
Demonstration of short-haul aircraft aft noise reduction techniques on a twenty inch [50.8] diameter fan, volume 2
[NASA-CR-134850] N80-15084
Demonstration of short haul aircraft aft noise reduction techniques on a twenty inch [50.8 cm] diameter fan, volume 3
[NASA-CR-134851] N80-15085
Acoustic analysis of aft noise reduction techniques measured on a subsonic tip speed 50.8 cm [twenty inch] diameter fan — quiet engine program
[NASA-CR-134891] N80-15102
Quiet Clean Short-Haul Experimental Engine [QCSEE]: Acoustic treatment development and design
[NASA-CR-135266] N80-15122
Evaluation of approximate methods for the prediction of noise shielding by airframe components
[NASA-TP-1004] N80-15129
Restoration of speckle images
[AD-A074626] N80-15920
NOMOGRAPHS
Nomograms for the calculation of propagation effects on tactical millimeter wave radio links
[AD-A073900] N80-15322
NONDESTRUCTIVE TESTS
Single-stage mass spectrometric analyses of resin bead samples
[ORNL/TM-6563] N80-15224
Measurement techniques for solar cells
[PB-301309/1] N80-15646
NONLINEAR EQUATIONS
Methods for numerical conformal mapping
[LA-7836-MS] N80-15857
Equivalence between resolvent consistency and convergence for nonlinear quasi-contractive algorithms
[ANL-79-53] N80-15863
NONLINEAR SYSTEMS
Ergodic theorems for nonlinear contraction semigroups in a Hilbert space
[ANL-79-50] N80-15860
NONLINEARITY
Linear and nonlinear symmetrically loaded shells of revolution approximated with the finite element method
[LA-7538-MS] N80-15439
NONRELATIVISTIC MECHANICS
Quantum mechanics with applications to quarkonium — Schroedinger equation
[COO-1764-360] N80-15970
NORMAL DENSITY FUNCTIONS
Method of normalizing the measured scattered light from a surface defect located arbitrarily in a Gaussian intensity distribution incident on a surface
[BDX-613-2287] N80-15957
NORTH AMERICA
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
NORTH DAKOTA
OCEA second-generation wheat yield model for hard red wheat in North Dakota N80-15513
Analysis of scanner data for crop inventories — North Dakota
[E80-10040] N80-15534
NOSES [FOREBODIES]
Control of forebody three-dimensional flow separations N80-15164
NOTCH TESTS
Evaluation of forgeability of steels by notch compression method
[RFP-TRANS-273] N80-15249
NOZZLE FLOW
Computation of three-dimensional flow in turbofan mixers and comparison with experimental data
[NASA-TM-81410] N80-15364
NUCLEAR ELECTRIC POWER GENERATION
Novel scheme for making cheap electricity with nuclear energy
[UCID-18153-REV-1] N80-15564
Nuclear strategy of the Department of Energy
[DOE/ER-0025/D] N80-15605
Fusion-supported decentralized nuclear energy system
[PPPL-1555] N80-15907
NUCLEAR ENGINE FOR ROCKET VEHICLES
Nuclear powered satellite studies
[COO-4045-4] N80-15198
NUCLEAR FISSION
Fission energy program of the U.S. Department of Energy, FY 1980
[DOE/ET-0089] N80-15893
Angular momentum and the collective modes excited in deep-inelastic processes and in fission
[LBL-9173] N80-15904
Fusion-supported decentralized nuclear energy system
[PPPL-1555] N80-15907
NUCLEAR FUELS
Cryogenic hydrogen data pertinent to magnetic fusion energy
[UCRL-52628] N80-15292
Thermal-stress analysis of rock formations for nuclear fuel and waste storage
[UCRL-81992] N80-15910
NUCLEAR FUSION
Cryogenic hydrogen data pertinent to magnetic fusion energy
[UCRL-52628] N80-15292
Fusion energy for hydrogen production — systems engineering of a process for hydrogen production from nuclear fusion
[BNL-24906] N80-15897
Fusion-supported decentralized nuclear energy system
[PPPL-1555] N80-15907
Pulsed power for fusion
[SAND-79-0933C] N80-15908
Superconductivity for mirror fusion
[UCRL-81693] N80-15933
Fusion: A possible option for solving long-term energy problems
[PB-300692/1] N80-15946
NUCLEAR MAGNETIC RESONANCE
Pulse and multiple pulse N.M.R. studies of crystallinity and molecular dynamics of solid state polymers
[IS-T-860] N80-15271
NUCLEAR POWER PLANTS
Elastic-plastic analyses for seismic reserve capacity in power plant braced frames
[UCRL-52614] N80-15303
Analysis of potential implementation levels for waste heat utilization in the nuclear power industry
[ORNL/TM-63-2] N80-15625
NUCLEAR REACTORS
DYNSYL: A general-purpose dynamic simulator for chemical processes
[UCRL-52561] N80-15219
NUCLEON-NUCLEON INTERACTIONS
Nucleon-nucleon scattering phase shifts
[ORO-5223-12] N80-15885
NUCLEON-NUCLEON SCATTERING
Nucleon-nucleon scattering phase shifts
[ORO-5223-12] N80-15885
NUCLEONICS
Large momentum transfer electron scattering from few-nucleon systems
[SLAC-PUB-2373] N80-15890
NUCLEONS
Large momentum transfer electron scattering from few-nucleon systems
[SLAC-PUB-2373] N80-15890
NUMERICAL ANALYSIS
The minimum cost approach to flutter clearance N80-15148
Analysis of the multiphase inductor-converter bridge — for the superconductive equilibrium field coils of the tokamak reactors and superconductive magnets used in particle accelerators
[CONF-790622-26] N80-15350
NUMERICAL CONTROL
Design of the digital control and test unit subsystems for a satellite signal analyzer
[AD-A073928] N80-15313
Aspects of computer control from the human engineering standpoint
[SLAC-PUB-2307] N80-15831
NUMERICAL INTEGRATION
Direct integration of transient rotor dynamics
[NASA-TP-1597] N80-15128

O

OCEAN CURRENTS
Correlation between wave slopes and near-surface ocean currents
[BNL-25068] N80-15773
Surface circulation in the northwestern Gulf of Mexico as deduced from drift bottles
[PB-299078/6] N80-15776
OCEAN SURFACE
Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results
[NASA-CR-156859] N80-15446

Woods Hole Oceanographic Institution Collection of Climatology and Air/Sea Interaction [CASI] data [AD-A075009] N80-15729
Correlation between wave slopes and near-surface ocean currents [BNL-25360] N80-15773
Surface circulation in the northwestern Gulf of Mexico as deduced from drift bottles [PB-299078/5] N80-15776
OCEAN THERMAL ENERGY CONVERSION
Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] N80-15543
Alternate cycles applied to ocean thermal energy conversion [SERI/TP-34-180] N80-15571
Review of water intake screening options for coastal water users with recommendations for Ocean Thermal Energy Conversion [OTEC] plants [ANL/OTEC-BCM-005] N80-15572
Qualification of aluminum for OTEC heat exchangers [ANL/OTEC-BCM-003] N80-15573
Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [ORO-5044-1] N80-15603
Environmental development plan ocean thermal energy conversion [DOE/EDP-0034] N80-15621
OTEC physical and climatic environmental impacts [CONF-790631-11] N80-15664
OCEANOGRAPHY
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10035] N80-15527
Woods Hole Oceanographic Institution Collection of Climatology and Air/Sea Interaction [CASI] data [AD-A075009] N80-15729
International Decade of Ocean Exploration, volume ? — information on oceanography programs dealing with marine environments [NOAA-S/T-78-211-VOL-?] N80-15772
OFFSHORE ENERGY SOURCES
Federal leasing and outer continental shelf energy production goals [DOE/RA-0037] N80-15640
OHMIC DISSIPATION
Global properties of chaotically heated reversed-field pinches [LA-UR-79-2346] N80-15934
OIL RECOVERY
Solar enhanced oil recovery: An assessment of economic feasibility [SAND-79-0787] N80-15641
OKLAHOMA
Study of the nature of ozone, oxides of nitrogen, and nonmethane hydrocarbons in Tulsa, Oklahoma. Volume 1: Project description and data summaries [PB-300481/9] N80-15229
OLIVINE
Physics of mantle and core minerals [E80-10038] N80-15532
ON-LINE PROGRAMMING
Information management problems relating to numeric data base services for DOE [DOE/TIC-10144] N80-15969
On-line information retrieval systems, volume 2: A bibliography with abstracts [NTIS/PS-79/0971/4] N80-15990
ONBOARD EQUIPMENT
Shuttle orbiter S-band payload communications equipment design evaluation [NASA-CR-160308] N80-15307
OPACITY
In-stack plume opacity from electrostatic precipitator/scrubber system at Barrington Unit 1 [PB-299215/4] N80-15686
OPERATING SYSTEMS [COMPUTERS]
Concepts leading to the IMAGE-100 hybrid interactive system N80-15466
USDA analyst review of the LACIE IMAGE-100 hybrid system test N80-15467
Operation of the yield estimation subsystem N80-15468
LACIE status and tracking N80-15470
LACIE/ERIPS software system summary N80-15477
Distributed, secure design for a multi-microprocessor operating system [AD-A073923] N80-15828
OPERATORS [MATHEMATICS]
SNEX: Semianalytic solution of the one-dimensional discrete ordinates [S/n] transport equations with diamond differenced angular fluxes [LA-7879-MS] N80-15856
OPTICAL COMMUNICATION
Light communication systems, volume 3. A bibliography with abstracts [NTIS/PS-79/0998/9] N80-15327
Fiber optics, volume 3. A bibliography with abstracts [NTIS/PS-79/1006/0] N80-15924
OPTICAL MEASURING INSTRUMENTS
Response characteristics of optical probes — for liquid-vapor interfaces [BNL-NUREG-24670] N80-15383
OPTICAL PROPERTIES
Theoretical investigation of the excitation structure and optical properties of titanium, vanadium and their oxides [AD-A074222] N80-15241
Considerations in the optical characterization of the atmosphere — meteorological parameters and optical properties of fog and haze [AD-A073680] N80-15747
Determination of optical constants for powdered materials in the 10 microns infrared region [AD-A074665] N80-15918
OPTICAL PUMPING
Optically pumped laser action and energy transfer in polyatomic molecules [AD-A074985] N80-15389
High energy Optical Resonance Transfer Laser study. Volume 1: Laboratory experiments [AD-A074126] N80-15399
OPTICAL RADAR
Technical papers on airborne laser hydrography [PB-299321/0] N80-15546
System considerations of a long range coherent lidar wind sensor with particular emphasis on real weather effects [PB-299972/0] N80-15757
OPTICAL WAVEGUIDES
Acoustically scanned optical imaging devices [AD-A074954] N80-15915
OPTIMAL CONTROL
Design criteria for optimal flight control systems — study of optimal flight control systems engineering for feedback control [AD-A074092] N80-15139
Analysis techniques for multivariate root loci — a tool in linear control systems [NASA-CR-162570] N80-15853
ORBIT PERTURBATION
Perturbations in perigee and eccentricity at the critical inclination [AD-A073975] N80-15192
ORBIT TRANSFER VEHICLES
Manned geosynchronous mission requirements and systems analysis study. Volume 1: Executive summary [NASA-CR-160429] N80-15186
Manned Orbital Transfer Vehicle [MOTV]. Volume 2: Mission handbook [NASA-CR-160430] N80-15187
Manned Orbital Transfer Vehicle [MOTV]. Volume 3: Program requirements documents [NASA-CR-160431] N80-15188
Manned Orbital Transfer Vehicle [MOTV]. Volume 4: Supporting analysis [NASA-CR-160432] N80-15189
Manned Orbital Transfer Vehicle [MOTV]. Volume 5: Turnaround analysis [NASA-CR-160433] N80-15190
Manned Orbital Transfer Vehicle [MOTV]. Volume 6: Five year program plan [NASA-CR-160434] N80-15191
ORBITAL MANEUVERS
Simple computations for near-optimum ascent and short maneuver targets and deorbit ignition time [NASA-TM-80850] N80-15185
ORBITAL MECHANICS
Differential orbit correction for near-stationary artificial satellites [AD-A074231] N80-15196
ORBITAL POSITION ESTIMATION
Comparison of C-band radar and Doppler geodetic accuracies in orbit determination [AD-A073877] N80-15193
Differential orbit correction for near-stationary artificial satellites [AD-A074231] N80-15196
ORBITALS
Simple computations for near-optimum ascent and short maneuver targets and deorbit ignition time [NASA-TM-80850] N80-15185
OREGON
Atmospheric structural variations that result in upwelling off Oregon [PB-301240/8] N80-15768
ORGANIC CHEMISTRY
Synchrotron radiation: A new tool for biophysical spectroscopy in the visible and ultraviolet [BNL-241[1]] N80-15225
ORGANIC COMPOUNDS
Houston area oxidant study detailed hydrocarbon analyses [PB-299629/4] N80-15674
ORGANOMETALLIC COMPOUNDS
The crystal structure and variable temperature Sn-119m Mossbauer study of trimethyltin glycinate, a one-dimensional, amino-bridged polymer [AD-A074383] N80-15955
ORTHOGONALITY
Calculation of two-dimensional inlet flow fields in a supersonic free stream by an implicit marching code with nonorthogonal mesh generation: User's manual [NASA-CR-3222] N80-15048
OSMIUM COMPOUNDS
Photoelectron spectra of trinuclear metal cluster complexes [CONF-790650-7] N80-15247
OVERVOLTAGE
Overvoltage protection by point-plane spark gaps [LA-UR-79-1655] N80-15345
OXIDATION
Coal sulfur measurements [PB-299575/1] N80-15294
OXIDES
Electronic structure of defects in oxides [ORO-4837-4] N80-15967
OXIDIZERS
Captive air bag design study — The relationship between oxidant concentrations in air and precursor levels [PB-299636/1] N80-15673
OXYGEN ANALYZERS
Performance evaluations of the orbisphere laboratories models 2702 and 2709 oxygen measuring systems [PB-300721/6] N80-15386
OZONE
Simultaneous cabin and ambient ozone measurements on two Boeing 747 airplanes, volume I [NASA-TM-79166] N80-15059
Study of the nature of ozone, oxides of nitrogen, and nonmethane hydrocarbons in Tulsa, Oklahoma. Volume 1: Project description and data summaries [PB-300481/9] N80-15229
Man's effect on stratospheric ozone [UCRL-82556] N80-15666
Captive air bag design study — The relationship between oxidant concentrations in air and precursor levels [PB-299636/1] N80-15673
Statistical analysis of the source-receptor relationships for ozone and haze in the Houston area [PB-299634/6] N80-15696
Global observation of stratospheric ozone by satellite [UCRL-82022] N80-15720
OZONOMETRY
Dobson spectrophotometer ozone measurements during international ozone rocketsonde intercomparison [NASA-TM-73294] N80-15727
OZONOSPHERE
Airborne measurements of solar and planetary near ultraviolet radiation during the NASA/ESA CV-900 spacelab simulation [NASA-CR-162566] N80-16012

P

PACIFIC ISLANDS
Summary of Synoptic Meteorological Observations [SSMO]. Selected South Pacific island marine areas, volume 2. Area 9: Isle Wallis. Area 10: Samoa Islands. Area 11: New Caledonia. Area 12: New Hebrides Islands. Area 13: Fiji Islands. Area 14: Tonga Islands. Area 15: Niue Island. Area 16: Rarotonga Island [Iower Cook Islands] [AD-A073446] N80-15745
Summary of Synoptic Meteorological Observations [SSMO]. Selected South Pacific island marine areas, volume 1. Area 1: Nauru Island and Ocean Island. Area 2: Gilbert Islands. Area 3: Canton and Phoenix Islands. Area 4: Christmas and Jarvis Islands. Area 5: Solomon Islands, Northeast. Area 6: Solomon Islands, Southwest. Area 7: Funafuti Atoll. Area 8: Marquesas Islands [AD-A073445] N80-15746
PAIN
Evoked potentials in immobilized cats to a combination of clicks with painful electrocutaneous stimuli [NASA-TM-75941] N80-15780
PANELS
Response of nonlinear structural panels subjected to high intensity noise [AD-A074969] N80-15432
PARAMETERIZATION
Parametric study of the Tormac fusion reactor concept [LA-7935-MS] N80-15931
PARTICLE ACCELERATORS
Pulsed power for fusion [SAND-79-0933C] N80-15908
PARTICLE BEAMS
Pulsed power for fusion [SAND-79-0933C] N80-15908
PARTICLE IN CELL TECHNIQUE
Investigation of efficiency optimization in free electron lasers [LA-UR-79-2176] N80-15400
PARTICLE INTERACTIONS
Production of neutrinos and neutrino-like particles in proton-nucleus interactions [SLAC-216] N80-15891
Quantum mechanics with applications to quarkonium. Schroedinger equation [COO-1764-260] N80-15970
PARTICLE MOTION
Particle dynamics in ion linear accelerator operating in double frequency regime [LA-TR-79-19] N80-15900
Relativistic electron beam propagation: Two-stream theory — using a mathematical mode to describe particle motion through a neutral gas [LA-7912-MS] N80-15905

Stochastic motion of particles in mirror machines [UCRL-82481] N80-15944
PARTICLE PRODUCTION
Production of neutrinos and neutrino-like particles in proton-nucleus interactions [SLAC-216] N80-15891
PARTICLE SIZE DISTRIBUTION
In situ exhaust cloud measurements — particle size distribution and cloud physics of rocket exhaust clouds N80-15651
Measurement of particulates N80-15652
Acid rain: Microphysical model N80-15656
Cirrus particle distribution study, part 4 [AD-A074763] N80-15735
Changes in cloud base precipitation particle size-distributions as a response variable to seeding [PB-299549/6] N80-15761
PARTICLES
Evaluation of stationary source particulate measurement methods. Volume 5: Secondary lead smelters [PB-300337/3] N80-15701
Evaluation of particulate emission factors for vehicle tire wear [PB-300443/9] N80-15702
PARTICULATE SAMPLING
Western energy sulfate/nitrate monitoring network [PB-299238/6] N80-15685
PASSENGERS
NASA technical advances in aircraft occupant safety — clear air turbulence detectors, fire resistant materials, and crashworthiness [NASA-TM-80851] N80-15060
PATHOGENS
Pathogen reduction in sludges by irradiation [SAND-78-1957C] N80-15996
PATTERN METHOD [FORECASTING]
Energy demand in the developing countries [DOE/EIA-0183/10] N80-15631
PATTERN RECOGNITION
Limited vocabulary continuous word recognition [AD-A074206] N80-15309
Manual interpretation of LANDSAT data N80-15460
The classification and measurement subsystem — wheat N80-15465
Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks N80-15479
On the clustering of multidimensional pictorial data N80-15493
On evaluating clustering procedures for use in classification N80-15494
Linear feature selection with applications N80-15496
Feature extraction applied to agricultural crops as seen by LANDSAT N80-15497
Methods of extending crop signatures from one area to another N80-15500
An evaluation of procedure 1 N80-15502
LACIE analyst interpretation keys N80-15505
Image and numerical display aids for manual interpretation N80-15508
Concept development of automated image analysis. Automated contour recognition and classification in aerial photography by means of angles and curvature [AD-A074439] N80-15540
PATTERN REGISTRATION
LACIE area sampling frame and sample selection N80-15452
LACIE registration processing N80-15456
Cartography: LACIE's spatial processor N80-15474
PAULI EXCLUSION PRINCIPLE
Integrability conditions for the existence of a Lagrangian in Newtonian mechanics and field theory — Pauli's exclusion principle [COO-4742-1] N80-15972
PAVEMENTS
Pavement evaluation and overlay design: A symposium and related papers [PB-299896/1] N80-15305
Quality Assurance: Performance, sealers and materials variation — pavements and construction materials [PB-299895/3] N80-15306
PENALTY FUNCTION
A first look at the effect of severe rainfall upon an aircraft [NASA-CR-162569] N80-15058
PENNSYLVANIA
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] N80-15526
PERFORMANCE PREDICTION
Summary of advanced methods for predicting high speed propeller performance [NASA-TM-81409] N80-15051
Comparison of predicted and experimental performance of large-bore roller bearing operating to 3.0 million DN [NASA-TP-1599] N80-15410
Analytical modeling of heat pump units as a design aid and for performance prediction [UCRL-52618] N80-15610
Computer science and technology: Computer Performance Evaluation Users Group [CPEUG], 15th — conference [PB-300468/5] N80-15833
PERFORMANCE TESTS
The effects of primary power transmission lines on the performance of LORAN-C receivers in experimental terrestrial applications [PB-301367/9] N80-15066
JA-6A circulation control wing contractor flight demonstration [AD-A074888] N80-15080
Turbine cycle performance improvement through titanium LP blades [EPRI-AF-903] N80-15417
Design and performance of silicon solar cells under concentrated sunlight [SAND-79-1169C] N80-15577
Long-term lithium battery tests [SAND-79-0487] N80-15608
Intermediate report on the performance of plate-type ice-maker heat pumps [ORNL/CON-23] N80-15619
PERIGEES
Perturbations in perigee and eccentricity at the critical inclination [AD-A073975] N80-15192
PERIODIC VARIATIONS
Stimulated emission by relativistic electrons traversing a periodic magnetic field [AD-A073888] N80-15396
PERSONNEL DEVELOPMENT
Development of the Rocky Mountain Energy and Environmental Technology Center: A preliminary analysis [ORAU-158] N80-15670
PERTURBATION
Trajectory behaviour of a control configurated aircraft subjected to random disturbances N80-15171
PERTURBATION THEORY
Baroclinic instability with variable gravity: A perturbation analysis [NASA-TP-1586] N80-15445
PETROLEUM PRODUCTS
Petrochemicals: Their economic significance in the domestic economy [PB-299733/6] N80-15992
PHASE DIAGRAMS
Advanced methods for preparation and characterization of infrared detector materials — crystallization and phase diagrams of Hg sub 1-x Cd sub x Te [NASA-CR-161352] N80-15948
On 1/N expansions and the phased diagram of discrete lattice gauge theories with matter fields — Ising model N80-15968
PHASE SHIFT
Nucleon-nucleon scattering phase shifts [ORO-5223-12] N80-15885
PHASE TRANSFORMATIONS
Melting in phase-change thermal storage media [COO-2993-1] N80-15584
PHASE-SPACE INTEGRAL
General least-squares fitting procedures to minimize the volume of a hyperellipsoid — linear accelerators [LA-UR-79-2330] N80-15855
Ray and wave optics of integrable and stochastic systems [LBL-9465] N80-15921
PHASED ARRAYS
Phased array antenna amplifier exploratory development model [AD-A074961] N80-15315
PHENOLOGY
Growth stage estimation — crop calendars N80-15458
Ancillary data acquisition for LACIE N80-15462
Prediction of wheat phenological development: A state-of-the-art review N80-15514
PHOTOCHEMICAL OXIDANTS
The Beryllium-7 program of the Houston area oxidants study [PB-299632/0] N80-15678
An analysis of atmospheric visibility data in the Houston area [PB-299633/8] N80-15680
Statistical analysis of the source-receptor relationships for ozone and haze in the Houston area [PB-299634/6] N80-15696
PHOTOCHEMICAL REACTIONS
Tunable lasers for waste management photochemistry applications [LA-7113-MS] N80-15402
Captive air bag design study — The relationship between oxidant concentrations in air and precursor levels [PB-299636/1] N80-15673
Photochemical aerosol dynamics [PB-299212/1] N80-15695
The chemistry of Venus' atmosphere [NASA-CR-159951] N80-16011
PHOTOCONDUCTIVITY
Modifications in optoelectronic behavior of plasma-deposited amorphous semiconductor alloys via impurity incorporation [BNL-26646] N80-15255
PHOTODIODES
Prospects of using large vacuum photodiodes with gas scintillation proportional counters [LA-UR-79-1246] N80-15382
PHOTOGEOLOGY
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] N80-15527
Geological and geothermal data use investigations for application explorer mission-A, heat capacity mapping mission [E80-10033] N80-15528
Geologic application of thermal inertia imaging using HCMM data — Cuprite, Elko, and Gothfield test areas, Nevada [E80-10035] N80-15529
PHOTOGRAMMETRY
Cartography: LACIE's spatial processor N80-15474
PHOTOINTERPRETATION
Manual interpretation of LANDSAT data N80-15460
On the clustering of multidimensional pictorial data N80-15493
Development of partitioning as an aid to spectral signature extension N80-15499
Manual LANDSAT data analysis for crop type identification N80-15504
A programmed labeling approach to image interpretation N80-15509
PHOTOLUMINESCENCE
Modifications in optoelectronic behavior of plasma-deposited amorphous semiconductor alloys via impurity incorporation [BNL-26646] N80-15255
PHOTOMAPS
US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain [PB-297931/8] N80-15547
PHOTOSYNTHESIS
Charge separation in synthetic photo-reaction centers [CONF-781048-1] N80-15784
PHOTOVOLTAIC CELLS
A survey of photovoltaic systems [NASA-CR-150696] N80-15363
Status of the US Department of Energy photovoltaic concentrator development project [SAND-78-2187C] N80-15578
Flywheel energy storage and conversion system for photovoltaic applications [COO-4094-48] N80-15635
Environmental development plan photovoltaics [DOE/EDP-0031] N80-15663
PHOTOVOLTAIC CONVERSION
Photovoltaic power system reliability considerations [NASA-TM-79291] N80-15422
PHOTOVOLTAIC EFFECT
Decentralized solar photovoltaic energy systems [LA-7866-TASE] N80-15565
Design of photovoltaic systems for residential applications in the United States [SAND-78-2186C] N80-15566
Description of the MIT/Lincoln Laboratory photovoltaic systems test facility [COO-4094-41] N80-15638
PHYSIOLOGICAL EFFECTS
Influence of hypokinesis on physiological functions in fowl [NASA-TM-75999] N80-15778
The course of experimental staphylococcus infection in albino mice during action of certain factors of space flight [NASA-TM-75973] N80-15779
Rat reaction to hypokinesia after prior adaptation to hypoxia [NASA-TM-75964] N80-15782
The physiological basis for spacecraft environmental limits [NASA-RP-1045] N80-15788
Atmosphere — physiological basis for spacecraft pressure tolerance limits N80-15789
Contaminants — physiological effects of spacecraft contaminants N80-15790

Thermal environment — physiological basis for temperature tolerance limits
N80-15791
Weightlessness — physiological effects
N80-15795
Changes of some blood indices and myocardial electrolyte content during hypokinesia
[NASA-TM-75954] N80-15798
PHYSIOLOGICAL RESPONSES
Visual accommodation responses in a virtual image environment
[AD-A074415] N80-15082
Circadian rhythms in air operations
N80-15816
PHYSIOLOGY
Activity of cholinesterases of blood and heart in rats of different sex and age during muscular loads and hypokinesia
[NASA-TM-75951] N80-15781
PIEZOELECTRIC TRANSDUCERS
Development of a high-voltage linear actuator amplifier system
[AD-A070266] N80-15343
PILOT PERFORMANCE
The effects of motion and g-seat cues on pilot simulator performance of three piloting tasks
[NASA-TP-1601] N80-15089
Effects of varying visual display characteristics of the T-4G, a T-37 flight simulator
[AD-A071403] N80-15180
PILOT PLANTS
Long-term erosion monitoring of metallic conduits by ultrasonic pulse-echo techniques — components of coal gasification and liquefaction pilot plants
[CONF-790480-1] N80-15259
PILOTS [PERSONNEL]
Biochemical indices of stress: Biochemical aspects of the stress response
N80-15812
PIPE FLOW
Vessel discharge by friction dominated tube flow
[UCRL-82801] N80-15375
PIPELINES
Bulletin of the Division of Mechanical Engineering and the National Aeronautical Establishment — design of a gas pipeline station control system and a railway switch car
[AD-A074885] N80-16022
PIPES [TUBES]
Long-term erosion monitoring of metallic conduits by ultrasonic pulse-echo techniques — components of coal gasification and liquefaction pilot plants
[CONF-790480-1] N80-15259
PISTON ENGINES
Free-piston Stirling engine demonstration test plan
[COO-2764-T3] N80-15567
PITCH [INCLINATION]
Quiet Clean Short-haul Experimental Engine [QCSEE]. Ball spline pitch change mechanism design report
[NASA-CR-134873] N80-15101
PLANE WAVES
Acoustic resonances and sound scattering by a shear layer
[NASA-CR-162575] N80-15873
PLANETARY COMPOSITION
Crystallization, flow and thermal histories of lunar and terrestrial compositions
[NASA-CR-162445] N80-16013
PLANETARY SURFACES
Reports of planetary geology program, 1979 - 1980 — bibliographies
[NASA-TM-81776] N80-16010
PLANETS
Reports of planetary geology program, 1979 - 1980 — bibliographies
[NASA-TM-81776] N80-16010
PLANTS [BOTANY]
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] N80-15527
Use of thermal infrared and colour infrared imagery to detect crop moisture stress — Alberta, Canada
[E80-10036] N80-15530
Response of selected plant and insect species to simulated SRM exhaust mixtures and to exhaust components from SRM fuels
N80-15657
PLASMA CONTROL
Iterative metric method for solving the inverse Tokamak equilibrium problem — for plasma control using the magnetohydrodynamic equilibrium equation
[PPPL-1564] N80-15941
PLASMA CYLINDERS
Plasma crowbars in cylindrical flux compression experiments — for simulating zeta pinch flux rate in plasma cylinders
[UCRL-82142] N80-15939
PLASMA DIAGNOSTICS
Diagnostic neutral beams for spectroscopic studies of impurities by charge-transfer reactions
[CONF-790585-2] N80-15887
PLASMA EQUILIBRIUM
Equilibrium and stability in strongly inhomogeneous plasmas
[LBL-8528] N80-15929
PLASMA FOCUS
Energy coupling in the plasma focus
[UCRL-83907] N80-15928
PLASMA GUNS
Compact 5 x 10-12 AMP/SEC rail-gun pulser for a laser plasma shutter
[UCRL-82599] N80-15407
PLASMA HEATING
Analysis of the early phase of Tokamak plasma ohmic heating
[WFPS-TME-79-018] N80-15927
PLASMA PHYSICS
Statistical theory of Langmuir turbulence
[LA-UR-79-576] N80-15940
PLASMA SLABS
Equilibrium and stability in strongly inhomogeneous plasmas
[LBL-8528] N80-15929
PLASMA WAVES
Theory of drift-wave eigenmodes in toroidal plasmas
[PPPL-1562] N80-15936
PLASMA-ELECTROMAGNETIC INTERACTION
Ray and wave optics of integrable and stochastic systems
[LBL-9465] N80-15921
Observation of stimulated Brillouin scattering in a microwave plasma interaction experiment
[PPG-422] N80-15935
Stimulated Thomson scattering
[COO-2387-104] N80-15963
PLASMAS [PHYSICS]
Coal sulfur measurements
[PB-299575/1] N80-15294
PULSAR: An inductive pulse power source
[SAND-79-1246C] N80-15627
Electron impact ionization of multicharged ions
[ORNL/TM-7020] N80-15879
Materials experience with Tokamak plasmas
[CONF-790125-56] N80-15943
PLASTIC DEFORMATION
Crack tip plasticity associated with corrosion assisted fatigue
[AD-A073835] N80-15435
More efficient creep ratcheting bounds — for cylindrical shells
[ORNL/SUB-7322/1] N80-15441
PLASTIC PROPERTIES
Unified creep-plasticity model for structural metals at high temperature
[ORNL/TM-5969] N80-15440
PLASTIC TAPES
Partial discharge performance of lapped plastic insulation for superconducting power transmission cables and the dielectric strength of supercritical helium gas
[BNL-24779] N80-15346
PLASTICS
Steady-state point-source excitation of a laminated composite
[AD-A074336] N80-15207
Petrochemicals: Their economic significance in the domestic economy
[PB-299733/6] N80-15992
PLATES [STRUCTURAL MEMBERS]
Classical analyses of laminated bimodulus composite-material plates
[AD-A074125] N80-15208
Inelastic analysis of transverse deflection of plates by the boundary element method
[COO-2733-24] N80-15438
PLATINUM
Two-dimensional avalanche breakdown in Pt-Si Schottky barrier diodes
[AD-A075010] N80-15954
PLUTONIUM
Single-stage mass spectrometric analyses of resin bead samples
[ORNL/TM-6563] N80-15224
POINTS [MATHEMATICS]
Analysis techniques for multivariate root loci — a tool in linear control systems
[NASA-CR-162570] N80-15853
POLAR CAPS
Extremely high latitude auroras, part 1
[AD-A074989] N80-15711
POLAR REGIONS
VLF/LF reflectivity of the polar ionosphere, 23 April - 2 September 1978
[AD-A074762] N80-15318
Extremely high latitude auroras, part 1
[AD-A074989] N80-15711
POLARIMETERS
Phase matrix measurements for electromagnetic scattering by sphere aggregates
[AD-A074466] N80-15916
POLARIZATION [CHARGE SEPARATION]
Charge separation in synthetic photo-reaction centers
[CONF-781048-1] N80-15784
POLARIZED LIGHT
Measurement of polarized light scattering via the Mueller matrix
[AD-A074431] N80-15922
POLICIES
Public policy issues in nuclear waste management
[PNL-2743] N80-15903
Institutional barriers to wastewater reuse
[PB-299027/3] N80-16002
POLLUTION
Houston area oxidant study detailed hydrocarbon analyses
[PB-299620/6] N80-15674
POLLUTION CONTROL
Quiet Clean Short-haul Experimental Engine [QCSEE]
[NASA-CR-159473] N80-15120
Coal sulfur measurements
[PB-299575/1] N80-15294
Sulfur fixation during coal gasification — desulfurizing to reduce air pollution
[PB-301104/6] N80-15296
Evaluation of granular bed filters for high-temperature/high-pressure particulate control — pollution control
[PB-299195/8] N80-15672
Socio-economic impact analysis of selected air pollution controls in the Houston-Galveston region
[PB-299635/3] N80-15679
EPA utility FGD [Flue Gas Desulfurization] survey: December 1978 - January 1979 — electric power plants
[PB-299399/6] N80-15682
Chemical aspects of afterburner systems
[PB-298465/6] N80-15684
In-stack plume opacity from electrostatic precipitor/scrubber system at Harrington Unit 1
[PB-299215/4] N80-15686
Pilot scale evaluation of NOx combustion control for pulverized coal, phase 2
[PB-299325/1] N80-15687
Field and laboratory studies for the development of effluent standards for the steam electric power industry
[PB-299097/6] N80-15689
Inventory of resources with emissions greater than 100 tons/year subject to organic material regulations in metropolitan Boston AQCR
[PB-298879/8] N80-15692
The cost of clean air and water report to Congress
[PB-300446/2] N80-15693
Investigation of the effects of the installation of an oxidation catalyst on a diesel powered vehicle
[PB-299928/2] N80-15699
Biological screening of complex samples from industrial/energy processes
[PB-300459/5] N80-15805
POLLUTION MONITORING
Study of the nature of ozone, oxides of nitrogen, and nonmethane hydrocarbons in Tulsa, Oklahoma. Volume 1: Project description and data summaries
[PB-300481/9] N80-15229
Pressure Modulator Radiometer [PMR] tests
[NASA-CR-159175] N80-15380
Atmospheric effects on laser beams, volume 2. A bibliography with abstracts
[NTIS/PS-79/0981/5] N80-15409
Air quality monitor and acid rain networks
N80-15659
Analysis of the measured effects of the principal exhaust effluents from solid rocket motors
[NASA-CR-3136] N80-15660
Houston area oxidant study detailed hydrocarbon analyses
[PB-299620/6] N80-15674
American-Soviet Symposium on Chemical Pollution of the Marine Environment, 1st
[PB-298343/5] N80-15683
Use of indicator species of algae to determine water quality
[PB-299953/0] N80-15694
Compliance status of major air pollution facilities
[PB-299959/7] N80-15700
POLYATOMIC MOLECULES
Optically pumped laser action and energy transfer in polyatomic molecules
[AD-A074985] N80-15309
Quantitative comparison of multiple-photon absorption in polyatomic molecules
[CONF-790690-3] N80-15892
POLYCARBONATES
Environmentally enhanced crazing in polymers
[UCRL-82488] N80-15272
POLYESTERS
Synthesis and characterization of new polyether based soluble polyurethanes
[SAND-78-1866C] N80-15273
POLYETHYLENES
Pulse and multiple pulse N.M.R. studies of crystallinity and molecular dynamics of solid state polymers
[IS-T-860] N80-15271
POLYIMIDE RESINS
Analyses of moisture in polymers and composites
[NASA-CR-159745] N80-15264
POLYMERIC FILMS
Vacuum ultraviolet electronic properties of liquids
[ORO-3861-28] N80-15217
Electrical activity in shock-loaded polymers
[SAND-79-0592C] N80-15270
Corrosion protection of solar-collector heat exchangers with electrochemically deposited films
[COO-4297-1] N80-15569
POLYMERS
Studies of HnFn oligomeric species
[AD-A074177] N80-15268

POLYPEPTIDES
Toxic polypeptides and uremia
[PB-301063/4] N80-15803
POLYPROPYLENE
Pulse and multiple pulse N.M.R. studies of crystallinity and molecular dynamics of solid state polymers
[IS-T-860] N80-15271
POLYSULFIDES
Apparent viscosities of setting elastomers — dental materials
[AD-A074843] N80-15267
POLYURETHANE RESINS
Synthesis and characterization of new polyether based acidate polyurethanes
[SAND-78-1866C] N80-15273
POSITION [LOCATION]
Precise relative location estimation from satellite laser observations — Geos 3 satellite
[NASA-CR-159953] N80-15336
POTABLE WATER
An evaluation of activated carbon for drinking water treatment
[PB-299968/8] N80-15228
Institutional barriers to wastewater reuse
[PB-299027/3] N80-16002
POTENTIAL FLOW
General potential theory of arbitrary wing sections
[NACA-452] N80-15046
A higher order panel method for three-dimensional potential flow
[AD-A074751] N80-15368
POTENTIAL THEORY
General potential theory of arbitrary wing sections
[NACA-452] N80-15046
Finite element method for the solution of a potential theory integral equation
[LBL-9504] N80-15839
POWDER [PARTICLES]
Determination of optical constants for powdered materials in the 10 micron infrared region
[AD-A074465] N80-15918
POWER AMPLIFIERS
Characteristics of electron oscillation and amplification. I. Power and frequency characteristics
[AD-A074761] N80-15337
Very fast, high-peak-power, planar triode amplifiers for driving optical gates
[UCRL-82538] N80-15358
POWER LINES
Transient analysis of multiconductor transmission line networks: A comparison of experimental and numerical results
[AD-A074950] N80-15344
POWER SPECTRA
Temporal and spatial power spectrum studies of numerical simulations of type 2 gradient drift irregularities in the equatorial electrojet
[AD-A073467] N80-15716
POWERED LIFT AIRCRAFT
Quiet Clean Short-haul Experimental Engine [QCSEE]
[NASA-CR-159473] N80-15120
Quiet powered-lift propulsion
[NASA-CP-2077] N80-15127
The YC-14 upper surface blown flap: A unique control surface
N80-15157
PRECIPITATION [METEOROLOGY]
Precipitable water over the United States. Volume 2: Semimonthly maxima
[PB-300870/3] N80-15753
PREDICTION ANALYSIS TECHNIQUES
A summary and evaluation of semi-empirical methods for the prediction of helicopter rotor noise
[NASA-TM-80200] N80-15875
PRESSURE DISTRIBUTION
Pressure distribution on Joukowski wings
[NACA-TM-336] N80-15036
The aerodynamic forces on airship hulls
[NACA-184] N80-15039
Remarks on the pressure distribution over the surface of an ellipsoid, moving translationally through a perfect fluid
[NACA-TM-196] N80-15041
Flow and force equations for a body revolving in a fluid
[NACA-323] N80-15044
A users guide for A344: A program using a finite difference method to analyze transonic flow over oscillating airfoils
[NASA-CR-159141] N80-15052
Exploratory studies of the cruise performance of upper surface blown configurations: Experimental program, high-speed pressure tests
[NASA-CR-159135] N80-15071
PRESSURE DRAG
Flow and drag formulas for simple quadrics — pressure drag and flow equations for an ellipsoid in incompressible fluids
[NACA-253] N80-15043
PRESSURE GRADIENTS
Arizona cool season climatological surface wind and pressure gradient study
[PB-298900/2] N80-15762
PRESSURE OSCILLATIONS
Pressure fluctuations on the surface of a cylinder in uniform flow
[NASA-CR-162468] N80-15362
Pressure Modulator Radiometer [PMR] tests
[NASA-CR-159175] N80-15380
PRESSURE VESSELS
Proceedings of the Hydride Storage Reservoir Symposium/Workshop
[BNL-26523] N80-15286
Vessel discharge by friction dominated tube flow
[UCRL-82801] N80-15375
PRESSURIZED CABINS
Atmosphere — physiological basis for spacecraft pressure tolerance limits
N80-15789
PRESTRESSING
Evaluation of feasibility of prestressed concrete for use in wind turbine blades
[NASA-CR-159725] N80-15553
PRINTED RESISTORS
The effects of substrate composition on thick film circuit reliability
[AD-A074907] N80-15333
PROBLEM SOLVING
Decision making and problem solving with computer assistance
[NASA-TM-76008] N80-15973
PRODUCTION ENGINEERING
Production of iron by direct reduction
[PB-300533/7] N80-15262
Scheduling of flexible flowshops [systems aspects of flexible manufacturing systems]
[PB-301218/4] N80-15979
PRODUCTIVITY
Comparison of diurnal fluctuations of dissolved inorganic carbon and algal productivity estimates in an oligotrophic and mesotrophic freshwater environment
[PB-301201/0] N80-15785
PROGRAM VERIFICATION [COMPUTERS]
Design and verification of reliable software
[AD-A074224] N80-15839
PROGRAMMING LANGUAGES
Rationale for the design of the ADA programming language: Volume 14, no. 6, part B
[AD-A073854] N80-15842
An assessment of software quality assurance — to strengthen ballistic missile defense systems command research
[AD-A074213] N80-15843
The FLEX system: User and caretaker's manual
[AD-A073997] N80-15844
Programming language design. A bibliography with abstracts
[NTIS/PS-79/0979/9] N80-15850
PROGRAMS
International Decade of Ocean Exploration, volume 7 — information on oceanography programs dealing with marine environments
[NOAA-S/T-78-211-VOL-7] N80-15772
PROJECT MANAGEMENT
Study of the nature of ozone, oxides of nitrogen, and nonmethane hydrocarbons in Tulsa, Oklahoma. Volume 1: Project description and data summaries
[PB-300481/9] N80-15229
LNG industry: An overview of projects and costs
[CONF-7811112-2] N80-15278
LACIE quality assurance
N80-15471
Functional definition and design of a USDA system
N80-15521
Project evaluation and quality control — weatherization
[PB-301041/5] N80-15647
Development of the Rocky Mountain Energy and Environmental Technology Center: A preliminary analysis
[ORAU-158] N80-15670
Management by objectives. A bibliography with abstracts
[NTIS/PS-79/0958/3] N80-15976
A program of management and technical assistance in the state of Washington — in support of economic growth
[PB-299276/6] N80-15977
PROJECT PLANNING
NASA/Army XV-15 tilt rotor research aircraft wind-tunnel test program plan — Ames 40-ft by 80-ft wind tunnel tests
[NASA-TM-78562] N80-15067
Manned Orbital Transfer Vehicle [MOTV]. Volume 3: Program requirements documents
[NASA-CR-160431] N80-15188
Manned Orbital Transfer Vehicle [MOTV]. Volume 6: Five year program plan
[NASA-CR-160434] N80-15191
SERAPH implementation plans
[SERI/RR-34-152] N80-15570
Laminated disk flywheel program
[UCRL-81772] N80-15612
Environmental development plan ocean thermal energy conversion
[DOE/EDP-0034] N80-15621
Solar energy meteorological research and training site, region 5 — project planning for education course in solar radiation and meteorology
[DOE/ET/20172-1] N80-15750
Fission energy program of the U.S. Department of Energy, FY 1980
[DOE/ET-0089] N80-15893
Technical support for open-cycle MHD program — project planning and systems analysis of a magnetohydrodynamic/steam power system
[ANL/MHD-78-11] N80-15942
A research agenda on science and technology for the handicapped
[PB-301220/0] N80-16005
PROPAGATION MODES
Comparison of inlet suppressor data with approximate theory based on cutoff ratio
[NASA-TM-81306] N80-15876
PROPAGATION VELOCITY
Propagation of normal zones in thermally insulated superconductors
[CONF-790815-16] N80-15351
Velocity model of the shallow lunar crust
[NASA-CR-162573] N80-16014
PROPELLER EFFICIENCY
Summary of advanced methods for predicting high speed propeller performance
[NASA-TM-81409] N80-15051
PROPORTIONAL COUNTERS
Prospects of using large vacuum photodiodes with gas scintillation proportional counters
[LA-UR-79-1246] N80-15382
PROPULSION SYSTEM CONFIGURATIONS
Hypersonic cruise aircraft propulsion integration study, volume 1
[NASA-CR-158926-VOL-1] N80-15074
Hypersonic cruise aircraft propulsion integration study, volume 2
[NASA-CR-158926-VOL-2] N80-15075
Quiet Clean Short-haul Experimental Engine [QCSEE] Over The Wing [OTW] design report
[NASA-CR-134846] N80-15086
Quiet Clean Short-haul Experimental Engine [QCSEE] preliminary over-the-wing flight propulsion system analysis report
[NASA-CR-135296] N80-15095
Quiet Clean Short-haul Experimental Engine [QCSEE] Over-The-Wing [OTW] boilerplate nacelle design report
[NASA-CR-135168] N80-15099
Quiet Clean Short-haul Experimental Engine [QCSEE]: The aerodynamic and mechanical design of the QCSEE under-the-wing fan
[NASA-CR-135009] N80-15109
Quiet Clean Short-haul Experimental Engine [QCSEE]
[NASA-CR-159473] N80-15120
Quiet Clean Short-Haul Experimental Engine [QSCEE]. Preliminary analyses and design report, volume 1
[NASA-CR-134838] N80-15123
Quiet Clean Short-Haul Experimental Engine [QCSEE]. Preliminary analyses and design report, volume 2
[NASA-CR-134839] N80-15124
Liquid oxygen/liquid hydrogen auxiliary power system thruster investigation
[NASA-CR-159674] N80-15202
PROPULSION SYSTEM PERFORMANCE
Quiet Clean Short-haul Experimental Engine [QCSEE] preliminary under the wing flight propulsion system analysis report
[NASA-CR-134866] N80-15088
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] engine composite nacelle test report. Volume 1: Summary, aerodynamic and mechanical performance
[NASA-CR-159471] N80-15094
Quiet Clean Short-haul Experimental Engine [QCSEE]. Under-The-Wing [UTW] engine boilerplate nacelle test report, volume 1
[NASA-CR-135249] N80-15096
Quiet Clean Short-haul Experimental Engine [QCSEE]. Under-The-Wing [UTW] engine boilerplate nacelle test report. Volume 3: Mechanical performance
[NASA-CR-135251] N80-15097
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears bearing development program
[NASA-CR-134890] N80-15105
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears detailed design report
[NASA-CR-134872] N80-15106
Quiet Clean Short-Haul Experimental Engine [QCSEE] Over-The-Wng [OTW] propulsion system test report. Volume 1: Summary report
[NASA-CR-135323] N80-15125
Quiet Clean Short-Haul Experimental Engine [QCSEE] Over-The Wing [OTW] propulsion system test report. Volume 2: Mechanical performance
[NASA-CR-135325] N80-15126
Energy storage system for automobile propulsion, 1978 study. 2: Detailed report
[UCRL-52553-VOL-2] N80-15995
PROTECTIVE COATINGS
Development of a special purpose spacecraft interior coating, phase 3
[NASA-CR-160441] N80-15199
PROTEIN METABOLISM
Mechanism of disorder of plastic processes in tissue during prolonged hypokinesia
[NASA-TM-75955] N80-15799

PROTON BEAMS
Calculation of quadripolar focusing of a linear accelerator and of beam adaptation in the presence of a space charge
[LA-TR-79-18] N80-15901
PROTONS
Production of neutrinos and neutrino-like particles in proton-nucleus interactions
[SLAC-216] N80-15891
PSYCHOMOTOR PERFORMANCE
Circadian rhythms of human performance and resistance: Operational aspects
N80-15808
PUBLIC LAW
Report to Congress on the economic impact of energy actions as required by public law 93-275, section 18-d
[DOE/PE-0007] N80-15993
PULSE GENERATORS
Pulser for vertically polarized dipole facility [VPD-2]
[AD-A074830] N80-15319
Applying a compensated pulsed alternator to a flashlamp load for NOVA
[UCRL-82475] N80-15408
PULSAR: An inductive pulse power source
[SAND-79-1246C] N80-15627
PULSE MODULATION
An experimental study of the instability of thruster controlled systems
[RAU-EI-74-2-C] N80-15329
PULSED LASERS
Pulsed dye laser OAS with a Helmholtz resonator cell
[CONF-790819] N80-15404
PULSED RADIATION
Pulsed power for fusion
[SAND-79-0933C] N80-15908
PYLONS
Direct side force and drag control with the aid of pylon split flaps
N80-15163
PYROMETALLURGY
Production of iron by direct reduction
[PB-300533/7] N80-15262
PYROXENES
Physics of mantle and core minerals
[E80-10038] N80-15532

Q

QUADRATURES
QINTEG: A program for computing Gaussian quadrature coefficients
[AD-A073974] N80-15845
QUADRUPOLES
Calculation of quadripolar focusing of a linear accelerator and of beam adaptation in the presence of a space charge
[LA-TR-79-18] N80-15901
QUALITY CONTROL
Quality Assurance: Performance, sealers and materials variation — pavements and construction materials
[PB-299895/3] N80-15306
Metallographic quality control of welding and brazing
[CONF-790730-1] N80-15425
The fracture of a parachute hook: A case study of the role of materials parameters in reliability analysis
[AR-001-591] N80-15429
LACIE quality assurance
N80-15471
Measurement techniques for solar cells
[PB-301309/1] N80-15646
Project evaluation and quality control — weatherization
[PB-301048/5] N80-15647
Evaluation of stationary source particulate measurement methods. Volume 5: Secondary lead smelters
[PB-300337/3] N80-15701
An assessment of software quality assurance — to strengthen ballistic missile defense systems command research
[AD-A079213] N80-15843
Development of a quality assurance methodology for the technical information generation subsystem of NTIPS
[AD-A074299] N80-15984
QUANTUM CHROMODYNAMICS
Quark structure functions of muons, fragmentation functions, higher-twist effects in QCD, deep inelastic scattering, and the Drell-Yan process
[SLAC-PUB-2362] N80-15883
QUANTUM MECHANICS
Scaled hydrogenic approximation wave functions
[UCID-18167] N80-15881
Stimulated Thomson scattering
[COO-2387-104] N80-15963
Quantum mechanics with applications to quarkonium — Schroedinger equation
[COO-1764-360] N80-15970
QUARKS
Deformed shapes of hadrons
[COO-3069-T1] N80-15882
Quark structure functions of muons, fragmentation functions, higher-twist effects in QCD, deep inelastic scattering, and the Drell-Yan process
[SLAC-PUB-2362] N80-15883
Quantum mechanics with applications to quarkonium — Schroedinger equation
[COO-1764-360] N80-15970
QUARTZ
Geologic application of thermal inertia imaging using HCMM data — Cuprite, Elko, and Goldfield test areas, Nevada
[E80-10035] N80-15529
QUEUEING THEORY
Symbolic priority queues
[AD-A076494] N80-15852
QUIET ENGINE PROGRAM
Demonstration of short-haul aircraft aft noise reduction techniques on a twenty inch [50.8 cm] diameter fan, volume 1
[NASA-CR-134849] N80-15083
Demonstration of short haul aircraft aft noise reduction techniques on a twenty inch [50.8 cm] diameter fan, volume 3
[NASA-CR-134851] N80-15085
Quiet Clean Short-haul Experimental Engine [QCSEE] Over The Wing [OTW] design report
[NASA-CR-134848] N80-15086
Quiet Clean Short-haul Experimental Engine [QCSEE]. Aerodynamic and aeromechanical performance of a 50.8 cm [20 inch] diameter 1.34 PR variable pitch fan with core flow
[NASA-CR-135017] N80-15087
Quiet Clean Short-haul Experimental Engine [QCSEE] preliminary under the wing flight propulsion system analysis report
[NASA-CR-134868] N80-15088
Quiet Clean Short-haul Experimental Engine [QCSEE]. The aerodynamic and mechanical design of the QCSEE over-the-wing fan
[NASA-CR-134915] N80-15089
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine digital control system design report
[NASA-CR-134920] N80-15090
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine simulation report
[NASA-CR-134914] N80-15091
Quiet Clean Short-haul Experimental Engine [QCSEE] over-the-wing control system design report
[NASA-CR-135337] N80-15092
Quiet Clean Short-haul Experimental Engine [QCSEE]. Core engine noise measurements
[NASA-CR-135166] N80-15093
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] engine composite nacelle test report. Volume I: Summary, aerodynamic and mechanical performance
[NASA-CR-159471] N80-15094
Quiet Clean Short-haul Experimental Engine [QCSEE] preliminary over-the-wing flight propulsion system analysis report
[NASA-CR-135296] N80-15095
Quiet Clean Short-haul Experimental Engine [QCSEE]. Under-The-Wing [UTW] engine boilerplate nacelle test report, volume 1
[NASA-CR-135249] N80-15096
Quiet Clean Short-haul Experimental Engine [QCSEE]. Under-The-Wing [UTW] engine boilerplate nacelle test report. Volume 3: Mechanical performance
[NASA-CR-135251] N80-15097
Quiet Clean Short-haul Experimental Engine [QCSEE] Composite fan frame subsystem test report
[NASA-CR-135010] N80-15098
Quiet Clean Short-haul Experimental Engine [QCSEE] Over-The-Wing [OTW] boilerplate nacelle design report
[NASA-CR-135168] N80-15099
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] composite nacelle subsystem test report — to verify strength of selected composite materials
[NASA-CR-135075] N80-15100
Quiet Clean Short-haul Experimental Engine [QCSEE]. Ball spline pitch change mechanism design report
[NASA-CR-134873] N80-15101
Acoustic analysis of aft noise reduction techniques measured on a subsonic tip speed 50.8 cm [twenty inch] diameter fan — quiet engine program
[NASA-CR-134891] N80-15102
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears test program
[NASA-CR-134669] N80-15103
Quiet Clean Short-haul Experimental Engine [QCSEE] clean combustor test report
[NASA-CR-134916] N80-15104
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears bearing development program
[NASA-CR-134890] N80-15105
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears detailed design report
[NASA-CR-134872] N80-15106
Quiet Clean Short-haul Experimental Engine [QCSEE]: Hamilton Standard cam/harmonic drive variable pitch fan actuation system detail design report
[NASA-CR-134852] N80-15107
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine composite fan blade design report
[NASA-CR-135046] N80-15108
Quiet Clean Short-haul Experimental Engine [QCSEE]: The aerodynamic and mechanical design of the QCSEE under-the-wing fan
[NASA-CR-135009] N80-15109
Quiet Clean Short-haul Experimental Engine [QCSEE] composite fan frame design report
[NASA-CR-135278] N80-15110
Quiet Clean Short-haul Experimental Engine [QCSEE] UTW fan preliminary design
[NASA-CR-134842] N80-15111
Quiet Clean Short-haul Experimental Engine [QCSEE]: The aerodynamic and preliminary mechanical design of the QCSEE OTW fan
[NASA-CR-134841] N80-15112
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine composite fan blade design
[NASA-CR-134840] N80-15113
Quiet Clean Short-haul Experimental Engine [QCSEE] over-the-wing engine and control simulation results
[NASA-CR-135049] N80-15114
Quiet Clean Short-Haul Experimental Engine [QCSEE] ball spline pitch-change mechanism whirl test report
[NASA-CR-135354] N80-15115
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] boiler plate nacelle and core exhaust nozzle design report
[NASA-CR-135008] N80-15116
Quiet Clean Short-haul Experimental Engine [QCSEE] whirl test of cam/harmonic pitch change actuation system
[NASA-CR-135140] N80-15117
Quiet Clean Short-haul Experimental Engine [QCSEE] Over-The-Wing [OTW] propulsion systems test report. Volume 4: Acoustic performance
[NASA-CR-135326] N80-15118
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] composite nacelle
[NASA-CR-135352] N80-15119
Quiet Clean Short-haul Experimental Engine [QCSEE]
[NASA-CR 159473] N80-15120
Quiet Clean Short-haul Experimental Engine [QCSEE]. Double-annular clean combustor technology development report
[NASA-CR-159483] N80-15121
Quiet Clean Short-Haul Experimental Engine [QCSEE]: Acoustic treatment development and design
[NASA-CR-135266] N80-15122
Quiet Clean Short-Haul Experimental Engine [QSCEE]. Preliminary analyses and design report, volume I
[NASA-CR-134838] N80-15123
Quiet Clean Short-Haul Experimental Engine [QCSEE]. Preliminary analyses and design report, volume 2
[NASA-CR-134839] N80-15124
Quiet Clean Short-Haul Experimental Engine [QCSEE] Over-The-Wing [OTW] propulsion system test report. Volume 1: Summary report
[NASA-CR-135323] N80-15125
Quiet Clean Short-Haul Experimental Engine [QCSEE] Over-The Wing [OTW] propulsion system test report. Volume 3: Mechanical performance
[NASA-CR-135325] N80-15126
Quiet powered-lift propulsion
[NASA-CP-2077] N80-15127

R

RADAR
A global ionospheric model
[AD-A074370] N80-15709
RADAR MEASUREMENT
Comparison of C-band radar and Doppler geoceiver accuracies in orbit determination
[AD-A073877] N80-15193
RADAR NAVIGATION
Comparison of C-band radar and Doppler geoceiver accuracies in orbit determination
[AD-A073877] N80-15193
RADAR RECEIVERS
Design study of a low cost civil aviation GPS receiver system
[NASA-CR-159176] N80-15062
Comparison of C-band radar and Doppler geoceiver accuracies in orbit determination
[AD-A073877] N80-15193
RADIATION ABSORPTION
Influence of clouds on UV-B penetration to the earth's surface
[NASA-CR-160428] N80-15703
RADIATION DAMAGE
Space solar cells: High efficiency and radiation damage
[NASA-TM-81387] N80-15554
Radiation damage in lithium-counterdoped n/p silicon solar cells
[NASA-TM-81391] N80-15557

Radiation damage annealing mechanisms and possible low temperature annealing in silicon solar cells [NASA-TM-81392] N80-15558
RADIATION DOSAGE
Electromagnetic fields in biological media. Part 2: The SCAT program, multilayered sphere, theory and applications [PB-300904/9] N80-15804
RADIATION HARDENING
Neutron hardness assurance guidelines for semiconductor devices [AD-A074882] N80-15951
RADIATION HAZARDS
Radiofrequency radiation — spacecraft environmental limits N80-15794
RADIATION MEASUREMENT
Global calibration of terrestrial reference cells and errors involved in using different irradiance monitoring techniques [NASA-TM-81393] N80-15561
RADIATION SOURCES
On the output of acoustical sources [NASA-CR-162576] N80-15872
RADIATION TOLERANCE
Radiation damage in lithium-counterdoped n/p silicon solar cells [NASA-TM-81391] N80-15557
RADIO ALTIMETERS
Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] N80-15446
RADIO ATTENUATION
Nomograms for the calculation of propagation effects on tactical millimeter wave radio links [AD-A073900] N80-15322
RADIO FREQUENCY INTERFERENCE
Power optimization in adaptive array: A technique for interference protection [AD-A074429] N80-15311
RADIO RELAY SYSTEMS
Nomograms for the calculation of propagation effects on tactical millimeter wave radio links [AD-A073900] N80-15322
RADIO SIGNALS
Synthesis of spread spectrum signals from the nonbinary Galois field [AD-A074604] N80-15312
RADIO WAVES
Radiofrequency radiation — spacecraft environmental limits N80-15794
RADIOACTIVE ISOTOPES
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program [LA-7980-PR] N80-15902
RADIOACTIVE WASTES
Seismic safety in nuclear-waste disposal [UCID-18125] N80-15894
Applicability of a generic monitoring program for radioactive waste burial grounds at Oak Ridge National Laboratory and Idaho National Engineering Laboratory [ORNL/SUB-7167-1] N80-15895
Geologic factors in nuclear waste disposal — computer simulation of radioactive waste transport from underground storage [UCRL-52522] N80-15896
Technical concept for a test of geologic storage of spent reactor fuel in the climax granite, Nevada Test Site [UCRL-52796] N80-15899
Public policy issues in nuclear waste management [PNL-2743] N80-15903
Environmental surveillance report for the INEL radioactive waste management complex [TREE-1357] N80-15909
Thermal-stress analysis of rock formations for nuclear fuel and waste storage [UCRL-81992] N80-15910
Rock mass characterization for storage of nuclear waste in granite [LBL-8570] N80-15911
Shallow land burial: Experience and developments at Oak Ridge and Los Alamos [LA-UR-79-1039] N80-15912
Intensive archeological survey of a potential defense waste processing facility site, Savannah River Plant, Aiken and Barnwell Counties, South Carolina. Research manuscript series 149 [DOE/SR-01072-3] N80-15913
RADIOGRAPHY
The application of image processing to the detection of corrosion by radiography [ARL/MAT-REPT-109] N80-15421
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program [LA-7980-PR] N80-15902
RADIOLYSIS
Hydrogen and methane syntheses through radiation catalysis [COO-4258-1] N80-15284
RADIOMETERS
Cloud Top Scanning radiometer [CTS] [NASA-CR-159954] N80-15381
RAIL TRANSPORTATION
Bulletin of the Division of Mechanical Engineering and the National Aeronautical Establishment — design of a gas pipeline station control system and a railway switch car [AD-A074885] N80-16022
RAIN
A first look at the effect of severe rainfall upon an aircraft [NASA-CR-162569] N80-15058
CTS attenuation and cross polarization measurements at 11.7 GHz [NASA-CR-159952] N80-15308
RANDOM ACCESS MEMORY
Induction over large data base [AD-A074075] N80-15987
RANDOM PROCESSES
Studies in astronomical time series analysis. Modeling random processes in the time domain [NASA-TM-81448] N80-15854
RANGEFINDING
Precise relative location estimation from satellite laser observations — Geos 3 satellite [NASA-CR-159953] N80-15536
RANGELANDS
US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain [PB-297931/8] N80-15547
RANK TESTS
Numerical rank determination in linear least squares problems [SAND-79-8243] N80-15861
RAPID TRANSIT SYSTEMS
New transportation systems and technology, 1979: Transportation research record 708 [PB-300747/3] N80-16000
RARE GASES
Prospects of using large vacuum photodiodes with gas scintillation proportional counters [LA-UR-79-1244] N80-15382
RAWINSONDES
The 19701A GSRS, missile number 022, round number B-21, 5 Jul. 1979 — weather and meteorological data [AD-A073391] N80-15739
Daily high-latitude 150 mb pressure maps from Twerle [Tropical Wind, reference level and energy conversion experiment] and rawinsondes. Part 1: 16 November 1975 - 31 January 1976 [PB-301343/0] N80-15766
RAYLEIGH SCATTERING
Rocketborne laser backscatter experiment [AD-A073853] N80-15398
Some features of Rayleigh scattering from light atoms and ions [UCRL-15046] N80-15886
REACTION KINETICS
Time-resolved spectroscopic studies of surface reactions [AD-A074952] N80-15216
Low temperature reaction path for coal liquefaction [SAND-79-0738C] N80-15288
Chemical aspects of afterburner systems [PB-298465/6] N80-15684
Chemical Kinetic Data Needs for Modeling the Lower Troposphere [PB-299439/0] N80-15722
Geochemistry of lunar and planetary processes [NASA-CR-162583] N80-16015
REACTOR CORES
SCRAP: Theory and modeling considerations [ANL-CT-79-49] N80-15997
REACTOR DESIGN
Compatibility of structural materials with fusion reactor coolant and breeder fluids [CONF-790125-77] N80-15906
Fusion-supported decentralized nuclear energy system [PPPL-1555] N80-15907
Pulsed power for fusion [SAND-79-0933C] N80-15908
Research on the HYLIFE liquid-first-wall concept for future laser fusion reactors [UCRL-15033] N80-15930
Parametric study of the Tormac fusion reactor concept [LA-7935-MS] N80-15931
Materials experience with Tokamak plasmas [CONF-790125-54] N80-15943
REACTOR MATERIALS
Aging behavior of alloy 800H and associated mechanical property changes — for nuclear reactors [GA-A-15194] N80-15251
Compatibility of structural materials with fusion reactor coolant and breeder fluids [CONF-790125-77] N80-15906
Materials experience with Tokamak plasmas [CONF-790125-54] N80-15943
REACTOR PHYSICS
Parametric study of the Tormac fusion reactor concept [LA-7935-MS] N80-15931
REACTOR SAFETY
Research on the HYLIFE liquid-first-wall concept for future laser fusion reactors [UCRL-15033] N80-15930
REAL TIME OPERATION
The LACIE data base: Design considerations N80-15475
RECEIVERS
Evaluation of the evacuated solar annular receivers used at the Midtemperature Solar Systems Test Facility (MSSTF) [SAND-78-0983] N80-15585
RECOILINGS
Investigation of adaptive control for recoil mechanisms [AD-A074024] N80-15851
RECOVERABILITY
Estimating the gas and dye quantities for modified tracer technique measurement of stream reaeration coefficients [PB-299015/8] N80-15690
RECYCLING
Technical barriers to the reuse of aluminum recovered from municipal refuse [PB-300436/5] N80-15261
Measurements and standards for recycled oil - 2 [PB-299951/4] N80-15275
Energy optimal use of waste paper [COO-2893-9] N80-15995
Energy conservation through point source recycle with high temperature hyperfiltration — textile industry [PB-299183/4] N80-15688
REENTRY EFFECTS
Aerodynamic heating on a multi-hundred watt heat source based on wind tunnel tests — for thermal simulation of reentry effects [AD-A074312] N80-15056
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program [LA-7980-PR] N80-15902
REENTRY VEHICLES
Time and space variation of density in the tropics [AD-A074472] N80-15714
REFLECTANCE
VLF/LF reflectivity of the polar ionosphere, 23 April - 2 September 1978 [AD-A074762] N80-15318
Development of a portable specular reflectometer for field measurements of solar mirror materials [SAND-78-1918] N80-15617
GATE radar CAPPI derivation for three-dimensional reflectivity analyses [PB-301263/0] N80-15765
REFLECTOMETERS
Development of a portable specular reflectometer for field measurements of solar mirror materials [SAND-78-1918] N80-15617
REFLECTORS
Back surface reflectors for solar cells [NASA-TM-81390] N80-15556
REFRACTIVITY
A simple model for calculating the index of refraction of neon I and neon [3S] in the cavity of a xenon fluoride laser [AD-A074380] N80-15392
Modeling the refractive index structure parameter in the marine planetary boundary layer [AD-A074275] N80-15710
Measurement of polarized light scattering via the Mueller matrix [AD-A074431] N80-15922
REFRACTORY METAL ALLOYS
Refractory metals for ultrasonic thermometry application [NUREG-CR-0368] N80-15253
REFRIGERATING MACHINERY
Intermediate report on the performance of plate-type ice-maker heat pumps [ORNL/CON-23] N80-15619
REGENERATORS
Sintered silicon nitride recuperator fabrication [NASA-CR-159706] N80-15263
REGIONAL PLANNING
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] N80-15526
REGRESSION ANALYSIS
Development of LACIE CCEA-1 weather/wheat yield models — regression analysis N80-15457
Status of yield estimation technology: A review of second-generation model development and evaluation N80-15510
Refinement of a statistical diagnostic model of marine fog using FNWC model output parameters [AD-A073959] N80-15730
REINFORCING FIBERS
FRS composites for advanced gas turbine engine components [AD-A074287] N80-15137
Analysis of a unidirectional composite containing broken fibers and matrix damage [NASA-CR-159185] N80-15205
Fatigue failure of composite laminates — graphite-epoxy composite materials [AD-A073899] N80-15209
Preparation of unidirectional fiber reinforced tantalum carbide composites [LA-UR-79-951] N80-15211

RELATIVISTIC ELECTRON BEAMS
Relativistic electron beam propagation: Two-stream theory — using a mathematical mode to describe particle motion through a neutral gas
[LA-7912-MS] N80-15905
Two-stream instability for a scattered beam propagating in a collisional plasma
[LA-UR-79-1607] N80-15945
RELATIVISTIC THEORY
Stimulated emission by relativistic electrons traversing a periodic magnetic field
[AD-A073888] N80-15396
Heavy ion collisions at relativistic energies
[LBL-9896] N80-15888
RELIABILITY
Cure 3, phase 1, volume 2
[NASA-CR-159123] N80-15424
Design and verification of reliable software
[AD-A074224] N80-15839
RELIABILITY ANALYSIS
Cure 3, Phase 1, volume 1
[NASA-CR-159122] N80-15423
Extended likelihood inference in reliability
[LA-7517-MS] N80-15426
RELIABILITY ENGINEERING
Photovoltaic power system reliability considerations
[NASA-TM-79291] N80-15422
The fracture of a parachute hook: A case study of the role of materials parameters in reliability analysis
[AR-001-591] N80-15429
REMOTE CONTROL
Man-machine communication in computer-aided remote manipulation
[AD-A074546] N80-15823
Teleoperation under the sea
[PB-299883/9] N80-15824
REMOTE SENSORS
Possible methods for distinguishing icebergs from ships by aerial remote sensing
[NASA-TM-79310] N80-15538
On-board multispectral classification study. Volume 2: Supplementary tasks — adaptive control
[NASA-CR-159178] N80-15539
Remote sensing of crosswind profiles using the correlation slope method
[AD-A074846] N80-15541
Remote sensing of agricultural resources. A bibliography with abstracts
[NTIS/PS-79/0993/0] N80-15542
Survey of satellite sensors and data with application to OTEC resource and operations requirements
[PB-300297/9] N80-15543
Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data
[ORO-5444-1] N80-15603
Global observation of atmospheric ozone by satellite
[UCRL-82028] N80-15720
Evaluation of the saturation resistant crosswind sensor
[AD-A074276] N80-15731
REQUIREMENTS
Mirror quality required by the Antares laser system
[LA-UR-79-2050] N80-15405
RESEARCH
Research and Technology Objectives and Plans Summary [RTOPS]. Research and Technology program, fiscal year 1980
[NASA-TM-80744] N80-15974
RESEARCH AIRCRAFT
NASA/Army XV-15 tilt rotor research aircraft wind-tunnel test program plan — Ames 40-ft by 80-ft wind tunnel tests
[NASA-TM-78562] N80-15067
RESEARCH AND DEVELOPMENT
Research and Technology Objectives and Plans Summary [RTOPS]. Research and Technology program, fiscal year 1980
[NASA-TM-80744] N80-15974
RESEARCH FACILITIES
Mass and emissions spectrometry in the Analytical Chemistry Division of Oak Ridge National Laboratory
[ORNL/TM-6485] N80-15226
RESEARCH MANAGEMENT
Research on low temperature, directed energy processing of very large scale integrated structures
[AD-A074127] N80-15340
Storm research
[PB-300299/7] N80-15760
A research agenda on science and technology for the handicapped
[PB-301220/5] N80-16005
RESIDENTIAL AREAS
Measurement of energy to heat houses: Initial study
[PB-299448/2] N80-15304
Application analysis of solar total energy systems to the residential sector. Volume 4: Market penetration
[ALO-3787-4] N80-15597
RESIDUAL STRESS
Investigation of elongation and its relationship to residual stresses in boron filaments
[AD-A074440] N80-15210
Anomalies in X-ray residual stress measurements in cold-rolled steels
[AD-A074802] *N80-15239*
RESINS
Single-stage mass spectrometric analysis of resin bead samples
[ORNL/TM-6563] N80-15214
RESONANCE
Acoustic resonances and sound scattering by a shear layer
[NASA-CR-162575] N80-15873
RESONANT FREQUENCIES
Critical speeds and natural frequencies of rim-type composite-material flywheels
[SAND-78-7049] N80-15632
RESONATORS
Pulsed dye laser OAS with a Helmholtz resonator cell
[CONF-790819] N80-15404
RESOURCES MANAGEMENT
Coastal atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] N80-15526
Water use alternatives for Navajo energy production
[LA-UR-79-1598] N80-15643
RETINAL ADAPTATION
Special session on vision
[LBL-9146] N80-15802
REVERSE FIELD PINCH
Global properties of ohmically heated reversed-field pinches
[LA-UR-79-2344] N80-15934
Physical conditions in reversed field pinches and theta pinches as inferred from simulations
[LA-UR-79-2368] N80-15937
REVOLVING
Flow and force equations for a body revolving in a fluid
[NACA-32] N80-15044
RHENIUM COMPOUNDS
Photoelectron spectra of trinuclear metal cluster complexes
[CONF-790658-7] N80-15247
RHYTHM (BIOLOGY)
Biological rhythms of man living in isolation from time cues
N80-15813
RIGID ROTORS
Effects of primary rotor parameters on flapping dynamics
[NASA-TP-1431] N80-15138
RIGID STRUCTURES
Comparison of boundary element and finite element methods in two-dimensional inelastic analysis
[COO-2733-22] N80-15864
RIVER BASINS
Intensive archeological survey of a potential defense waste processing facility site, Savannah River Plant, Aiken and Barnwell Counties, South Carolina. Research manuscript series 149
[DOE/SR-01072-3] N80-15913
RIVERS
Statistical summaries of Arizona streamflow data
[PB-299354/1] N80-15550
ROCKET ENGINE DESIGN
Liquid oxygen/liquid hydrogen auxiliary power system thruster investigation
[NASA-CR-159674] N80-15202
ROCKET EXHAUST
Proceedings of Shuttle Environmental Effects Program Review — conferences
[NASA-CP-2110] N80-15649
Cloud volume studies — study of rocket exhaust clouds through nephanalysis and cloud physics
N80-15650
In situ exhaust cloud measurements — particle size distribution and cloud physics of rocket exhaust clouds
N80-15651
Measurement of particulates
N80-15652
Ice nuclei measurements from solid rocket motor effluents
N80-15653
Ground-based measurements of DM-2 rocket exhaust effluents using fixed-flow samplers and electrets
N80-15654
Response of selected plant and insect species to simulated SRM exhaust mixtures and to exhaust components from SRM fuels
N80-15657
The investigation of man-made modifications of the ionosphere — effects of detonations and rocket exhaust
[NASA-CR-162579] N80-15707
ROCKET PROPELLED SLEDS
Attempt to measure sonic boom caustics supersonic HVAR rocket sleds
[SAND-78-1541] N80-15878
ROCKET SOUNDING
The 19701A GSRS, missile numbers 304, 305, 307, round numbers B-22, B-23, B-24, *5 July 1979*
[AD-A073392] *N80-15737*
ROCKS
Thermal-stress analysis of rock formations for nuclear fuel and waste storage
[UCRL-81992] *N80-15910*
ROLLER BEARINGS
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears bearing development program
[NASA-CR-134990] N80-15805
Comparison of predicted and experimental performance of large-bore roller bearing operating to 3.0 million DN
[NASA-TP-1599] N80-15410
ROOM TEMPERATURE
Uniaxial creep, cyclic creep and relaxation of AISI type 304 stainless steel at room temperature: An experimental study
[AD-A074958] N80-15240
ROTARY WINGS
CH-46 composite rotor blade flight stress survey data. Volume 3: Plotted forward rotor blade chord, torsion and absolute loads
[AD-A075612] N80-15077
Analysis of low-speed helicopter flight test data
[AD-A074141] N80-15079
Model 540 rotor blade crack propagation investigation
[AD-A074734] N80-15081
Effects of primary rotor parameters on flapping dynamics
[NASA-TP-1431] N80-15138
A summary and evaluation of semi-empirical methods for the prediction of helicopter rotor noise
[NASA-TM-80200] N80-15875
ROTATING DISKS
Laminated disk flywheel program
[UCRL-81772] N80-15612
ROTATING SHAFTS
Direct integration of transient rotor dynamics
[NASA-TP-1597] N80-15128
ROTOR AERODYNAMICS
Effects of primary rotor parameters on flapping dynamics
[NASA-TP-1431] N80-15138
ROTORS
Direct integration of transient rotor dynamics
[NASA-TP-1597] N80-15128
RUBIDIUM COMPOUNDS
Photoelectron spectra of trinuclear metal cluster complexes
[CONF-790658-7] N80-15247

S

SAFETY FACTORS
Seismic safety in nuclear-waste disposal
[UCID-18125] N80-15894
SALT BEDS
Heat transfer studies in salt and granite
[ORNL/ENG/TM-14] N80-15581
SALTON SEA (CA)
Geothermal energy development from the Salton Trough to the High Cascades — Cerro Prieto, Lower California and Mt. Hood, Oregon
[LBL-8703] N80-15568
SALYUT SPACE STATION
Results of medical studies during long-term manned flights on the orbital Salyut-6 and Soyuz complex
[NASA-TM-76014] N80-15797
SAMPLING
LACIE sampling design
N80-15451
SATELLITE CONFIGURATIONS
Configuration effects on satellite charging response
[NASA-TM-81397] N80-15200
SATELLITE DESIGN
Solar power satellite system definition study. Volume I: Executive summary
[NASA-CR-160442] N80-15195
SATELLITE ORBITS
Perturbations in perigee and eccentricity at the critical inclination
[AD-A073975] N80-15192
Differential orbit correction for near-stationary artificial satellites
[AD-A074231] N80-15196
SATELLITE SOLAR ENERGY CONVERSION
Solar power satellite system definition study. Volume I: Executive summary
[NASA-CR-160442] N80-15195
SATELLITE TRACKING
Precise relative location estimation from satellite laser observations — Geos 3 satellite
[NASA-CR-159953] N80-15536
SCALE MODELS
Scale modeling of finite length fluid annular gaps for flow-induced vibration testing
[ANL-CT-79-40] N80-15436
SCATTERING CROSS SECTIONS
On the multiple scattering of waves from obstacles with solid-fluid interfaces
[AD-A074057] N80-15433
Some features of Rayleigh scattering from light atoms and ions
[UCRL-15046] *N80-15886*
Hydrogen scattering cross section, 1H[n,n]1H
[LA-7895-MS] N80-15958
SCENE ANALYSIS
On the clustering of multidimensional pictorial data
N80-15493

Colorimetric consideration of transparencies for a typical LACIE scene
N80-15506

SCHEDULING
Aircraft delays at major US airports can be reduced
[PB-299442/4] N80-15061
Scheduling of flexible flowshops [systems aspects of flexible manufacturing systems]
[PB-301218/4] N80-15979

SCHOTTKY DIODES
Two-dimensional avalanche breakdown in Pt-Si Schottky barrier diodes
[AD-A075010] N80-15954

SCHROEDINGER EQUATION
Quantum mechanics with applications to quarkonium — Schroedinger equation
[COO-1764-360] N80-15970

SCINTILLATION COUNTERS
Prospects of using large vacuum photodiodes with gas scintillation proportional counters
[LA-UR-79-1246] N80-15382

SCREEN EFFECT
Electromagnetic transmission through an annular aperture in an infinite conducting screen
[AD-A074831] N80-15320

SCREW DISLOCATIONS
Effect of point defects on mechanical properties of metals
[COO-1367-97] N80-15245

SCRUBBERS
In-stack plume opacity from electrostatic precipitator/scrubber system at Harrington Unit 1
[PB-299215/4] N80-15686

SEA WATER
Review of water intake screening options for coastal water users with recommendations for Ocean Thermal Energy Conversion [OTEC] plants
[ANL/OTEC-BCM-005] N80-15572

SEALING
Plasma-sprayed dual density ceramic turbine seal system
[NASA-CR-159739] N80-15411

SEARCHING
Study of message text formats: Bibliographic search queries — computer networks for libraries and information services
[ISSN-0160-9742] N80-15981

SEAS
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] N80-15527

SEASAT SATELLITES
Survey of satellite sensors and data with application to OTEC resource and operations requirements
[PB-300297/9] N80-15543

SEDATIVES
Hypnotics and the management of disturbed sleep
N80-15818

SEDIMENT TRANSPORT
Watershed erosion and sediment transport model
[PB-299070/7] N80-15551

SEISMIC WAVES
Wave propagation in viscoelastic media
[UCRL-83019] N80-15378
Seismic safety in nuclear-waste disposal
[UCID-18125] N80-15894
SCRAP: Theory and modeling considerations
[ANL-CT-79-49] N80-15997
Velocity model of the shallow lunar crust
[NASA-CR-162572] N80-16014

SEISMOGRAPHS
Elastic-plastic analyses for seismic reserve capacity in power plant braced frames
[UCRL-52614] N80-15303

SELENIUM
Tripling of CO2 laser radiation in DBr, DCl and Se
[COO-4253-7] N80-15406

SEMICONDUCTING FILMS
Modifications in optoelectronic behavior of plasma-deposited amorphous semiconductor alloys via impurity incorporation
[BNL-26646] N80-15255

SEMICONDUCTOR DEVICES
Electrical and optical properties of high purity p-type single crystals of GeFe2O4
[AD-A073994] N80-15949
Neutron hardness assurance guidelines for semiconductor devices
[AD-A074882] N80-15951

SEMICONDUCTORS [MATERIALS]
Studies of metal-semiconductor interfaces in catalysis and energy conversion
[COO-4946-1] N80-15221
Study of electronic transport and breakdown in thin insulating films
[AD-A074457] N80-15342
Semiconductor Measurement Technology: NBS/DOE Workshop, Stability of [Thin Film] Solar Cells and Materials
[PB-299964/7] N80-15644
Liquid phase epitaxial growth of gallium arsenide
[AR-001-668] N80-15947
Optically induced hot electron effects in semiconductors
[AD-A073920] N80-15952
Topographic examination of semiconductor systems
[AD-A075007] N80-15953

SEPARATED FLOW
Separation jump and sudden stall over an ellipsoidal wind at incidence — wing flow method tests for investigating laminar boundary layer, boundary layer transition, and separated flow
[AD-A074260] N80-15054
Fundamental studies of subsonic and transonic flow separation. Part 3: Third phase summary report
[AD-A074868] N80-15057
An analytical and experimental study of a short s-shaped subsonic diffuser of a supersonic inlet
[NASA-TM-81406] N80-15134
Control of fuselage three-dimensional flow separations
N80-15164

SEWAGE TREATMENT
Waste stabilization lagoon microorganism removal efficiency and effluent disinfection with chlorine
[PB-300631/9] N80-15786
Effect of infrared radiation on compaction of municipic wastewater sludges
[PB-298296/5] N80-15998
Progress in wastewater disinfection technology — coalescence
[PB-299338/4] N80-16001

SHAPED CHARGES
Active experiments using rocket-borne shaped charge barium releases — solar-terrestrial magnetospheric physics
[NASA-CR-162581] N80-15708

SHEAR LAYERS
Characterization of acoustic disturbances in linearly sheared flows
[NASA-CR-162577] N80-15869
Features of sound propagation through and stability of a finite shear layer
[NASA-CR-162465] N80-15870
Acoustic resonances and sound scattering by a shear layer
[NASA-CR-162575] N80-15873

SHEAR STRENGTH
Evaluation of the vane shear test in Louisiana
[PB-298872/3] N80-15723

SHELL THEORY
Linear and nonlinear symmetrically loaded shells of revolution approximated with the finite element method
[LA-7538-MS] N80-15439

SHELLS [STRUCTURAL FORMS]
Mitigating effects in the plastic failure of shells subjected to axially dependent dynamic pressure loadings
[COO-4122-27] N80-15443

SHIPS
VTS processing display subsystem design — to prevent environmental damage in harbor areas
[AD-A074053] N80-15830

SHOCK WAVE GENERATORS
Liquid-liquid contact in vapor explosion
[ANL/RAS-78-37] N80-15285

SHOCK WAVE INTERACTION
Electrical activity in shock-loaded polymers
[SAND-79-0592C] N80-15270

SHOCK WAVES
Dynamics of vortices and shock waves in nonuniform media
[AD-A072842] N80-15366

SHORT HAUL AIRCRAFT
Demonstration of short-haul aircraft aft noise reduction techniques on a twenty inch [50.8 cm] diameter fan, volume 1
[NASA-CR-134849] N80-15083
Demonstration of short-haul aircraft aft noise reduction techniques on a twenty inch [50.8] diameter fan, volume 2
[NASA-CR-134850] N80-15084
Demonstration of short haul aircraft aft noise reduction techniques on a twenty inch [50.8 cm] diameter fan, volume 3
[NASA-CR-134851] N80-15085
Quiet Clean Short-haul Experimental Engine [QCSEE] Over The Wing [OTW] design report
[NASA-CR-134846] N80-15086
Quiet Clean Short-haul Experimental Engine [QCSEE]. Aerodynamic and aeromechanical performance of a 50.8 cm [20 inch] diameter 1.34 PR variable pitch fan with core flow
[NASA-CR-135017] N80-15087
Quiet Clean Short-haul Experimental Engine [QCSEE] preliminary under the wing flight propulsion system analysis report
[NASA-CR-134866] N80-15088
Quiet Clean Short-haul Experimental Engine [QCSEE]. The aerodynamic and mechanical design of the QCSEE over-the-wing fan
[NASA-CR-134915] N80-15089
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine digital control system design report
[NASA-CR-134920] N80-15090
Quiet Clean Short-haul Experimental Engine [QCSEE] over-the-wing control system design report
[NASA-CR-135337] N80-15092
Quiet Clean Short-haul Experimental Engine [QCSEE]. Core engine noise measurements
[NASA-CR-135160] N80-15093
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] engine composite nacelle test report. Volume 1: Summary, aerodynamic and mechanical performance
[NASA-CR-159471] N80-15094
Quiet Clean Short-haul Experimental Engine [QCSEE] preliminary over-the-wing flight propulsion system analysis report
[NASA-CR-135296] N80-15095
Quiet Clean Short-haul Experimental Engine [QCSEE]. Under-The-Wing [UTW] engine boilerplate nacelle test report, volume 1
[NASA-CR-135249] N80-15096
Quiet Clean Short-haul Experimental Engine [QCSEE]. Under-The-Wing [UTW] engine boilerplate nacelle test report. Volume 3: Mechanical performance
[NASA-CR-135251] N80-15097
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] composite nacelle subsystem test report — to verify strength of selected composite materials
[NASA-CR-135075] N80-15100
Quiet Clean Short-haul Experimental Engine [QCSEE]. Ball spline pitch change mechanism design report
[NASA-CR-134875] N80-15101
Acoustic analysis of aft noise reduction techniques measured on a subsonic tip speed 50.8 cm [twenty inch] diameter fan — quiet engine program
[NASA-CR-134891] N80-15102
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears test program
[NASA-CR-134669] N80-15103
Quiet Clean Short-haul Experimental Engine [QCSEE] clean combustor test report
[NASA-CR-134916] N80-15104
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears bearing development program
[NASA-CR-134890] N80-15105
Quiet Clean Short-haul Experimental Engine [QCSEE]: Hamilton Standard cam/harmonic drive variable pitch fan actuation system detail design report
[NASA-CR-134852] N80-15107
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine composite fan blade design report
[NASA-CR-135046] N80-15108
Quiet Clean Short-haul Experimental Engine [QCSEE]. The aerodynamic and mechanical design of the QCSEE under-the-wing fan
[NASA-CR-135009] N80-15109
Quiet Clean Short-haul Experimental Engine [QCSEE] composite fan frame design report
[NASA-CR-135278] N80-15110
Quiet Clean Short-haul Experimental Engine [QCSEE] UTW fan preliminary design
[NASA-CR-134842] N80-15111
Quiet Clean Short-haul Experimental Engine [QCSEE]: The aerodynamic and preliminary mechanical design of the QCSEE OTW fan
[NASA-CR-134843] N80-15112
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine composite fan blade design
[NASA-CR-134840] N80-15113
Quiet Clean Short-haul Experimental Engine [QCSEE] over-the-wing engine and control simulation results
[NASA-CR-135049] N80-15114
Quiet Clean Short-Haul Experimental Engine [QCSEE] ball spline pitch-change mechanism whirling test report
[NASA-CR-135354] N80-15115
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] boiler plate nacelle and core exhaust nozzle design report
[NASA-CR-135008] N80-15116
Quiet Clean Short-haul Experimental Engine [QCSEE] whirl test of cam/harmonic pitch change actuation system
[NASA-CR-135140] N80-15117
Quiet Clean Short-haul Experimental Engine [QCSEE] Over-The-Wing [OTW] propulsion systems test report. Volume 4: Acoustic performance
[NASA-CR-135326] N80-15118
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] composite nacelle
[NASA-CR-135352] N80-15119
Quiet Clean Short-haul Experimental Engine [QCSEE]
[NASA-CR-159473] N80-15120
Quiet Clean Short-haul Experimental Engine [QCSEE]. Double-annular clean combustor technology development report
[NASA-CR-159483] N80-15121
Quiet Clean Short-Haul Experimental Engine [QCSEE]: Acoustic treatment development and design
[NASA-CR-135266] N80-15122
Quiet Clean Short-Haul Experimental Engine [QSCEE]. Preliminary analyses and design report, volume 1
[NASA-CR-134838] N80-15123
Quiet Clean Short-Haul Experimental Engine [QCSEE]. Preliminary analyses and design report, volume 2
[NASA-CR-134839] N80-15124

SHORT TAKEOFF AIRCRAFT
JA-6A circulation control wing contractor flight demonstration
[AD-A074308] N80-15080
Evaluation of approximate methods for the prediction of noise shielding by airframe components
[NASA-TP-1606] N80-15120
The YC-14 upper surface blown flap: A unique control surface
N80-15157

SIDELOBE REDUCTION
Antenna sidelobe and interference reduction. A bibliography with abstracts
[NTIS/PS-79/1013/4] N80-15325

SIGNAL ANALYZERS
Design of the digital control and test unit subsystem for a satellite signal analyzer
[AD-A077925] N80-15313

SIGNAL PROCESSING
Synthesis of spread spectrum signals from the non-binary Galois field
[AD-A074604] N80-15312
Narrowband voice system
[AD-A074445] N80-15314
An in-depth study of the sensitivity of wave digital filters
[AD-A077952] N80-15338

SIGNATURE ANALYSIS
The use of classifiers and microprocessors for target classification on using millimeter wave signatures
[AD-A074040] N80-15317
Manual interpretation of LANDSAT data
N80-15480
The classification and measurement subsystem — wheat
N80-15465
Accuracy assessment system and operation
N80-15472
Methods for segment wheat area estimation
N80-15491
Compensation for atmospheric effects in LANDSAT data
N80-15498
Development of partitioning as an aid to spectral signature extension
N80-15499
Manual LANDSAT data analysis for crop type identification
N80-15504
LACIE analyst interpretation keys
N80-15505
Image and numerical display aids for manual interpretation
N80-15508
A programmed labeling approach to image interpretation
N80-15509
Analysis of scanner data for crop inventories — North Dakota
[E80-10040] N80-15534

SILICON
Analysis of GaAs and Si solar cell arrays for earth orbital and orbit transfer missions
[NASA-TM-81383] N80-15204
Electric characteristics of ion-implanted laser-annealed silicon
[CONF-780932-4] N80-15352
Design and performance of silicon solar cells under concentrated sunlight
[SAND-79-1165C] N80-15577
Two-dimensional avalanche breakdown in Pt-Si Schottky barrier diodes
[AD-A075010] N80-15954

SILICON CARBIDES
Adhesion and friction of iron-base binary alloys in contact with silicon carbide in vacuum
[NASA-TP-1604] N80-15234

SILICON DIOXIDE
Characteristics of thick non-planar SiO2 coatings — surface finishing laser fusion targets
[UCRL-81842] N80-15213
Dielectric strength of SiO2 in a CMOS transistor structure
[SAND-79-1715C] N80-15965

SILICON NITRIDES
Sintered silicon nitride recuperator fabrication
[NASA-CR-159706] N80-15263

SILICON TRANSISTORS
Dielectric strength of SiO2 in a CMOS transistor structure
[SAND-79-1715C] N80-15965

SILICONES
Apparent viscosities of setting elastomers — dental materials
[AD-A074843] N80-15267

SINGLE CRYSTALS
Liquid phase epitaxial growth of gallium arsenide
[AR-001-466] N80-15947
Electrical and optical properties of high purity p-type single crystals of GeFe2O4
[AD-A073998] N80-15949

SITES
Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data
[ORO-5444-1] N80-15603

SLEEP
Sleep, Wakefulness and Circadian Rhythm
[AGARD-LS-105] N80-15806
Sleep stage organization: Neuro endocrine relations
N80-15809
Biological rhythms of man living in isolation from time cues
N80-15813
Hypnotics and the management of disturbed sleep
N80-15818

SLEEP DEPRIVATION
Sleep disturbances in humans
N80-15810
Sleep disturbance and performance
N80-15814

SLENDER BODIES
Studies of non-linear aerodynamic characteristics of finned slender bodies at high angles of attack
[TAE-340] N80-15032

SLUDGE
Pathogen reduction in sludges by irradiation
[SAND-78-1957C] N80-15996
Effect of infrared radiation on compaction of municipal wastewater sludges
[PB-298296/5] N80-15998

SOCIAL FACTORS
Satellite television in Indonesia
[PB-299524/9] N80-15328
Socio-economic impact analysis of selected air pollution controls in the Houston-Galveston region
[PB-299635/5] N80-15679

SODIUM SULFATES
Experimental studies of the formation/deposition of sodium sulfate in/from combustion gases — hot corrosion of gas turbine engine components
[NASA-CR-159753] N80-15131

SOIL MECHANICS
Soil analyses and evaluations at the impact dynamics research facility for two full-scale aircraft crash tests
[NASA-CR-159199] N80-15299
Evaluation of the vane shear test in Louisiana
[PB-298872/3] N80-15723
An analytic method for strong motion studies in layered media
[PB-301116/0] N80-15725

SOIL MOISTURE
Topographical characteristics through the study of the thermal and hydrological dissuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
[E80-10028] N80-15447
The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE
N80-15482
Application of LANDSAT digital data for monitoring drought — South Dakota
N80-15483
Use of thermal infrared and colour infrared imagery to detect crop moisture stress — Alberta, Canada
[E80-10036] N80-15530
HCMM/soil moisture experiment — Alberta, Canada
[E80-10037] N80-15531

SOLAR ACTIVITY
The sudden commencement solar proton flux enhancement of 31 October 1972
[AD-A074546] N80-16017
Imaging X-ray spectrometer to study solar activity in conjunction with the SCADM program
[LA-UR-79-1921] N80-16019
Solar-geophysical data number 414, supplement, February 1979. Part 2: Comprehensive reports. DTA for December 1978, November 1978 and miscellanea
[PB-299340/0] N80-16020
Solar geophysical data number 418, June 1979. Part 1: Prompt reports. Data for May 1979, April 1979. Explanation of data reports issued as number 414 [supplement] February 1979
[PB-299694/0] N80-16021

SOLAR ARRAYS
Analysis of GaAs and Si solar cell arrays for earth orbital and orbit transfer missions
[NASA-TM-81383] N80-15204

SOLAR CELLS
Analysis of GaAs and Si solar cell arrays for earth orbital and orbit transfer missions
[NASA-TM-81383] N80-15204
Space solar cells: High efficiency and radiation damage
[NASA-TM-81387] N80-15554
Open-circuit voltage improvements in low resistivity solar cells
[NASA-TM-81388] N80-15555
Back surface reflectors for solar cells
[NASA-TM-81390] N80-15556
Radiation damage in lithium-counterdoped n/p silicon solar cells
[NASA-TM-81391] N80-15557
Radiation damage annealing mechanisms and possible low temperature annealing in silicon solar cells
[NASA-TM-81392] N80-15558
Global calibration of terrestrial reference cells and errors involved in using different irradiance monitoring techniques
[NASA-TM-81393] N80-15561
Characterization of three types of silicon solar cells for SEPS deep space missions. Volume 1: Current-voltage characteristics of OCLI BSF/BSR 10 ohm-cm, and BSR 2 ohm-cm cells as a function of temperature and intensity
[NASA-TM-78253] N80-15562
A survey of photovoltaic systems
[NASA-CR-150696] N80-15563
Design and performance of silicon solar cells under concentrated sunlight
[SAND-79-1165C] N80-15577
Semiconductor Measurement Technology: NBS/DOE Workshop, Stability of [Thin Film] Solar Cells and Materials
[PB-299964/7] N80-15644
Measurement techniques for solar cells
[PB-301309/1] N80-15646
Environmental development plan photovoltaics
[DOE/EDP-0031] N80-15663

SOLAR COLLECTORS
Corrosion protection of solar-collector heat exchangers with electrochemically deposited films
[COO-4297-1] N80-15569
Evaluation of the evacuated solar annular receivers used at the Midtemperature Solar Systems Test Facility [MSSTF]
[SAND-78-0983] N80-15585
Analysis of field test results for single-axis-tracking solar collector foundations
[SAND-79-7023] N80-15586
Performance of residential solar heating and cooling systems with flat-plate and evacuated tubular collectors: CSU Solar House I
[COO-2577-17] N80-15616

SOLAR COOLING
National program plan for passive and hybrid solar heating and cooling
[DOE/CS-0089] N80-15598
Conference on performance monitoring techniques for evaluation of solar heating and cooling systems
[CONF-780432] N80-15599
Performance of residential solar heating and cooling system with flat-plate and evacuated tubular collectors: CSU Solar House I
[COO-2577-17] N80-15616

SOLAR CORONA
Analysis of X-ray and EUV spectra of solar active regions
[NASA-CR-161366] N80-16016

SOLAR ELECTRIC PROPULSION
Characterization of three types of silicon solar cells for SEPS deep space missions. Volume 1: Current-voltage characteristics of OCLI BSF/BSR 10 ohm-cm, and BSR 2 ohm-cm cells as a function of temperature and intensity
[NASA-TM-78253] N80-15562

SOLAR ENERGY
Photovoltaic power system reliability considerations
[NASA-TM-79291] N80-15422
Evaluation of the evacuated solar annular receivers used at the Midtemperature Solar Systems Test Facility [MSSTF]
[SAND-78-0983] N80-15585
Dynamic storage in solar total energy programs
[SAND-78-0958C] N80-15600
Solar mechanical energy storage program overview and systems analysis results
[SAND-79-1642C] N80-15637
Solar enhanced oil recovery: An assessment of economic feasibility
[SAND-79-0787] N80-15641
Solar energy meteorological research and training site, region 5 — project planning for education course in solar radiation and meteorology
[DOE/ET/20172-1] N80-15750

SOLAR ENERGY CONVERSION
Decentralized solar photovoltaic energy systems
[LA-7866-TASE] N80-15565
SERAPH implementation plans
[SERI/RR-34-152] N80-15570
Department of Energy large solar central power systems semiannual review
[SAND-78-8511] N80-15601
Department of Energy large solar central power systems semiannual review
[SAND-79-8508] N80-15602
Solar/wind handbook for Hawaii: Technical applications for Hawaii, the Pacific Basin and sites worldwide with similar climatic conditions
[UCRL-15053] N80-15628
Role of the government in the development of solar energy
[SERI/TP-52-138] N80-15639

SOLAR FLARES
The reaction of the atmosphere to solar disturbances
[NASA-TM-75500] N80-15704
Solar flare spectroscopic diagnostics for wavelengths less than 2000 angstroms
[AD-A070569] N80-16018

SOLAR FLUX
The sudden commencement solar proton flux enhancement of 31 October 1972
[AD-A074546] N80-16017

SOLAR GENERATORS
Department of Energy large solar central power systems semiannual review
[SAND-78-8511] N80-15601

SOLAR HEATING
Candidate thermal energy storage technologies for solar industrial process heat applications
[NASA-TM-81580] N80-15560
National program plan for passive and hybrid solar heating and cooling
[DOE/CS-0089] N80-15598
Conference on performance monitoring techniques for evaluation of solar heating and cooling systems
[CONF-780432] N80-15599
Performance of residential solar heating and cooling system with flat-plate and evacuated tubular collectors: CSU Solar House I
[COO-2577-17] N80-15616
SOLAR HOUSES
Performance of residential solar heating and cooling system with flat-plate and evacuated tubular collectors: CSU Solar House I
[COO-2577-17] N80-15616
SOLAR PONDS [HEAT STORAGE]
Stability considerations and a double-diffusive convection model for solar ponds
[ANL-CT-79-34] N80-15587
SOLAR POWER SATELLITES
Solar power satellite system definition study. Volume 1: Executive summary
[NASA-CR-160442] N80-15195
SOLAR PROTONS
The sudden commencement solar proton flux enhancement of 31 October 1972
[AD-A074546] N80-16017
SOLAR RADIATION
Application of Monte Carlo techniques to insolation characterizations and prediction
[SERI/RR-36-306] N80-15579
Input data for solar systems
[DOE/TIC-10193] N80-15580
Influence of clouds on UV-B penetration to the earth's surface
[NASA-CR-160428] N80-15703
Solar energy meteorological research and training site, region 5 — project planning for education course in solar radiation and meteorology
[DOE/ET/20172-1] N80-15750
Airborne measurements of solar and planetary near ultraviolet radiation during the NASA/ESA CV-900 spectrum simulation
[NASA-CR-162566] N80-16012
SOLAR RADIO EMISSION
Solar-geophysical data number 414, supplement, February 1979. Part 2: Comprehensive reports. DTA for December 1978, November 1978 and miscellanea
[PB-299340/0] N80-16020
Solar geophysical data number 418, June 1979. Part 1: Prompt reports. Data for May 1979, April 1979. Explanation of data reports issued as number 414 [supplement] February 1979
[PB-299694/0] N80-16021
SOLAR REFLECTORS
Development of a portable specular reflectometer for field measurements of solar mirror materials
[SAND-78-1918] N80-15617
SOLAR SPECTRA
Solar flare spectroscopic diagnostics for wavelengths less than 2000 angstroms
[AD-A070569] N80-16018
SOLAR SPECTROMETERS
Solar flare spectroscopic diagnostics for wavelengths less than 2000 angstroms
[AD-A070569] N80-16018
SOLAR TERRESTRIAL INTERACTIONS
The reaction of the atmosphere to solar disturbances
[NASA-TM-75500] N80-15704
Active experiments using rocket-borne shaped charge barium releases — solar-terrestrial magnetospheric physics
[NASA-CR-162581] N80-15708
SOLAR TOTAL ENERGY SYSTEMS
SERAPH implementation plans
[SERI/RR-34-152] N80-15570
Methodology for determining the configuration of the optimum solar total energy system
[SAND-79-0422] N80-15574
Application analysis of solar total energy systems to the residential sector. Volume 4: Market penetration
[ALO-3787-4] N80-15597
SOLAR X-RAYS
Analysis of X-ray and EUV spectra of solar active regions
[NASA-CR-161364] N80-16016
SOLID PROPELLANT ROCKET ENGINES
Proceedings of Shuttle Environmental Effects Program Review — conferences
[NASA-CP-2110] N80-15649
Ice nuclei measurements from solid rocket motor effluents
N80-15653
Response of selected plant and insect species to simulated SRM exhaust mixtures and to exhaust components from SRM fuels
N80-15657
Analysis of the measured effects of the principal exhaust effluents from solid rocket motors
[NASA-CR-3126] N80-15660
SOLID WASTES
Management of coal preparation fine wastes without disposal ponds
[PB-299100/8] N80-15691
SOLID-SOLID INTERFACES
Studies of metal-semiconductor interfaces in catalysis and energy conversion
[COO-4946-1] N80-15221
SOLIDS
Wave propagation in viscoelastic media
[UCRL-83019] N80-15378
SOLVENTS
Vacuum ultraviolet electronic properties of liquids
[ORO-3861-28] N80-15217
SONIC BOOMS
Attempt to measure sonic boom caustics supersonic HVAR rocket sleds
[SAND-78-1541] N80-15878
SOUND GENERATORS
On the concept of acoustical sources
[NASA-CR-162576] N80-15872
SOUND PROPAGATION
Features of sound propagation through and stability of a finite shear layer
[NASA-CR-162465] N80-15870
Comparison of inlet suppressor data with approximate theory based on cutoff ratio
[NASA-TM-81386] N80-15876
SOUNDING ROCKETS
Dobson spectrophotometer ozone measurments during international ozone rocketsonde intercomparison
[NASA-TM-73284] N80-15727
SOURCES
Compliance status of major air pollution facilities
[PB-299959/7] N80-15700
SOUTH CAROLINA
Intensive archeological survey of a potential defense waste processing facility site, Savannah River Plant, Aiken and Barnwell Counties, South Carolina. Research manuscript series 149
[DOE/SR-01072-3] N80-15913
Intensive archeological survey of a potential independent spent fuel storage facility, Savannah River Plant, Aiken and Barnwell Counties, South Carolina, research manuscript series 141
[DOE/SR-01072-1] N80-15914
SOUTH DAKOTA
Application of LANDSAT digital data for monitoring drought — South Dakota
N80-15483
SOUTHERN HEMISPHERE
Global observation of atmospheric ozone by satellite
[UCRL-82028] N80-15720
SOYUZ SPACECRAFT
Results of medical studies during long-term manned flights on the orbital Salyut-6 and Soyuz complex
[NASA-TM-76014] N80-15797
SPACE
District space heating potential of low temperature hydrothermal geothermal resources in the southwestern United States — using computerized simulation
[NMEI-10-1] N80-15582
SPACE CHARGE
Calculation of quadripolar focusing of a linear accelerator and of beam adaptation in the presence of a space charge
[LA-TR-79-18] N80-15901
SPACE ENVIRONMENT SIMULATION
Evaluation of 100 mm bore bearings after accelerated testing in a simulated space environment
[AD-A074527] N80-15413
SPACE HEATING [BUILDINGS]
Measurement of energy to heat houses: Initial study
[PB-299448/2] N80-15304
Low temperature thermal energy storage: A state-of-the-art survey
[SERI/RR-54-164] N80-15583
Fuel utilization in residences
[EPRI-EA-894] N80-15604
SPACE MISSIONS
International space activities, 1979
[GPO-53-451] N80-15184
Manned geosynchronous mission requirements and systems analysis study. Volume 1: Executive summary
[NASA-CR-160429] N80-15186
SPACE PROGRAMS
International space activities, 1979
[GPO-53-451] N80-15184
Toward the endless frontier: History of the Committee on Science and Technology 1959 - 1979
[GPO-35-120] N80-15994
SPACE SHUTTLE MAIN ENGINE
Evaluation of worn SSME low pressure liquid oxygen turbopump bearing
[NASA-CR-161367] N80-15412
SPACE SHUTTLE ORBITERS
Shuttle orbiter S-band payload communications equipment design evaluation
[NASA-CR-160438] N80-15307
Detailed description of the HP-9825A HFRMP trajectory processor [TRAJ]
[NASA-CR-160440] N80-15836
SPACE SHUTTLES
Simple computations for near-optimum ascent and abort maneuver targets and deorbit ignition time
[NASA-TM-80850] N80-15185
Proceedings of Shuttle Environmental Effects Program Review — conferences
[NASA-CP-2110] N80-15649
Analysis of the measured effects of the principal exhaust effluents from solid rocket motors
[NASA-CR-3126] N80-15660
SPACE TRANSPORTATION SYSTEM
Advanced oxygen-hydrocarbon rocket engine study
[NASA-CR-161350] N80-15203
SPACEBORNE PHOTOGRAPHY
Remote sensing of agricultural resources. A bibliography with abstracts
[NTIS/PS-79/0993/0] N80-15542
US Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain
[PB-297931/8] N80-15547
SPACECRAFT CHARGING
Configuration effects on satellite charging response
[NASA-TM-81397] N80-15200
SPACECRAFT COMMUNICATION
Shuttle orbiter S-band payload communications equipment design evaluation
[NASA-CR-160438] N80-15307
SPACECRAFT CONTAMINATION
Contaminants — physiological effects of spacecraft contaminants
N80-15790
SPACECRAFT DESIGN
Shuttle orbiter S-band payload communications equipment design evaluation
[NASA-CR-160438] N80-15307
Economical space power systems
[NASA-CR-159696] N80-15559
SPACECRAFT ENVIRONMENTS
The physiological basis for spacecraft environmental limits
[NASA-RP-1045] N80-15788
Atmosphere — physiological basis for spacecraft pressure tolerance limits
N80-15789
Contaminants — physiological effects of spacecraft contaminants
N80-15790
Thermal environment — physiological basis for temperature tolerance limits
N80-15791
Sound and noise — in spacecraft
N80-15793
Radiofrequency radiation — spacecraft environmental limits
N80-15794
Weightlessness — physiological effects
N80-15795
SPACECRAFT POWER SUPPLIES
Nuclear powered satellite studies
[COO-4045-4] N80-15198
Economical space power systems
[NASA-CR-159696] N80-15559
SPACECRAFT STRUCTURES
Development of a special purpose spacecraft interior coating, phase 3
[NASA-CR-160441] N80-15199
SPACECRAFT TRAJECTORIES
Detailed description of the HP-9825A HFRMP trajectory processor [TRAJ]
[NASA-CR-160440] N80-15836
SPAIN
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] N80-15527
SPARK GAPS
Overvoltage protection by point-plane spark gaps
[LA-UR-79-1655] N80-15345
Sympathetic breakdown on gaps in air
[SAND-79-0598C] N80-15355
SPATIAL FILTERING
Compact 5 x 10-12 AMP/SEC rail-gun pulser for a laser plasma shutter
[UCRL-82539] N80-15407
SPECKLE PATTERNS
Restoration of speckle images
[AD-A074626] N80-15920
SPECTRA
Spectral, far-field, and near-field measurements of five light-emitting diodes
[AD-A074517] N80-15339
SPECTRAL RECONNAISSANCE
Design, implementation, and results of LACIE field research
N80-15519
SPECTRAL REFLECTANCE
The vegetative index number and crop identification
N80-15503
SPECTRAL SENSITIVITY
Colorimetric consideration of transparencies for a typical LACIE scene
N80-15506
SPECTRAL SIGNATURES
On the clustering of multidimensional pictorial data
N80-15493
Feature extraction applied to agricultural crops as seen by LANDSAT
N80-15497
Compensation for atmospheric effects in LANDSAT data
N80-15498

Development of partitioning as an aid to spectral signature extension
N80-15499
Methods of extending crop signatures from one area to another
N80-15500
Signature extension methods in crop area estimation
N80-15501
LACIE analyst interpretation keys
N80-15505
Generation of uniform chromaticity scale imagery from LANDSAT data
N80-15507
SPECTROMETERS
Synchrotron radiation: A new tool for biophysical spectroscopy in the visible and ultraviolet [BNL-24811]
N80-15225
SPECTROPHOTOMETRY
Dobson spectrophotometer ozone measurements during international ozone rocketsonde intercomparison [NASA-TM-73284]
N80-15727
SPECTROSCOPY
Bilocal field theory and a model for meson spectroscopy, part 1. Trident production by high energy charged particles on nuclei, part 2 [IS-T-861]
N80-15899
SPECTRUM ANALYSIS
Diagnostic neutral beams for spectroscopic studies of impurities by charge-transfer reactions [CONF-790505-2]
N80-15887
Auger lineshape analysis of molecules and solids [SAND-79-1240C]
N80-15956
Analysis of X-ray and EUV spectra of solar active regions [NASA-CR-161364]
N80-16016
Solar flare spectroscopic diagnostics for wavelengths less than 2000 angstroms [AD-A070569]
N80-16018
SPECULAR REFLECTION
Development of a portable specular reflectometer for field measurements of solar mirror materials [SAND-78-1918]
N80-15617
SPEECH
Narrowband voice system [AD-A074445]
N80-15314
SPHERICAL SHELLS
Analytical solutions for open nonshallow spherical shell vibrations [AD-A074269]
N80-15434
SPIN TESTS
Sandia composite-rim flywheel development [SAND-78-1865C]
N80-15624
SPIN-LATTICE RELAXATION
Local electronic properties of dilute magnetic alloys [SAN-0034-T4]
N80-15966
SPOILERS
Roll control by digitally controlled segment spoilers
N80-15156
In-flight measured characteristics of combined flap-spoiler direct lift controls
N80-15165
Unsteady aerodynamics of two-dimensional spoilers at low speeds
N80-15170
SPOT WELDS
Loading tests of a wing structure for a hypersonic aircraft [NASA-TP-1596]
N80-15068
STABILITY
Stability considerations and a double-diffusive convection model for solar ponds [ANL-CT-79-34]
N80-15587
Semiconductor Measurement Technology: NBS/DOE Workshop, Stability of [Thin Film] Solar Cells and Materials [PB-299964/7]
N80-15644
Bifurcation and stability in Yang-Mills theory with sources [COO-3069-655]
N80-15971
STAINLESS STEELS
Uniaxial creep, cyclic creep and relaxation of AISI type 304 stainless steel at room temperature: An experimental study [AD-A074958]
N80-15240
STANDARDIZATION
Data model processing: An approach to standardization of database management systems [AD-A074601]
N80-15827
STANDARDS
Measurements and standards for recycled oil - 2 [PB-299951/4]
N80-15275
STATIC AERODYNAMIC CHARACTERISTICS
Evaluation of the aerodynamic characteristics of a 1/20-scale A-10 model at Mach numbers from 0.30 to 0.75 [AD-A074867]
N80-15055
STATISTICAL ANALYSIS
Sampling, aggregation, and variance estimation for area, yield, and production in LACIE
N80-15449
LACIE sampling design
N80-15451
LACIE area sampling frame and sample selection
N80-15452
Accuracy assessment: The statistical approach to performance evaluation in LACIE — Great Plains corridor, United States
N80-15459
Accuracy assessment system and operation
N80-15472
A programmed labeling approach to image interpretation
N80-15509
Statistical summaries of Arizona streamflow data [PB-299354/1]
N80-15550
Survey of statistical techniques used in validation studies of air pollution prediction models [COO-2874-50]
N80-15665
STATISTICAL DISTRIBUTIONS
Extended likelihood inference in reliability [LA-7517-MS]
N80-15426
Estimating crop proportions from remotely sensed data
N80-15492
Federal Energy Data System [FEDS] statistical summary update [DOE/EIA-0192]
N80-15630
Edwards AFB, Lancaster, California, Revised Uniform Summary of Surface Weather Observations [RUSSWO] [AD-A074691]
N80-15734
STATISTICAL MECHANICS
Statistical theory of Langmuir turbulence [LA-UR-79-576]
N80-15940
STATISTICAL TESTS
New developments in sampling and aggregation for remotely sensed surveys
N80-15515
Natural sampling strategy
N80-15516
STEADY FLOW
Numerical procedure for calculating steady/unsteady, single-phase/two-phase three-dimensional fluid flow with heat transfer [NUREG-CR-0782]
N80-15376
STEAM
Corrosion of several alloys in superheated steam at 482 and 538 deg centigrade [ORNL/TM-6465]
N80-15252
Characterization of operating conditions for gas/water heat recovery steam generators [ORNL/TM-6622]
N80-15620
Technical support for open-cycle MHD program — project planning and systems analysis of a magnetohydrodynamic/steam power system [ANL/MHD-78-11]
N80-15942
STEAM TURBINES
Turbine cycle performance improvement through titanium LP blades [EPRI-AF-903]
N80-15417
STEEL STRUCTURES
Long-term erosion monitoring of metallic conduits by ultrasonic pulse-echo techniques — components of coal gasification and liquefaction pilot plants [CONF-790480-1]
N80-15259
Elastic-plastic analyses for seismic reserve capacity in power plant braced frames [UCRL-52614]
N80-15303
STEELS
Environmental hydrogen cracking of HY steel weld metals [AD-A074104]
N80-15237
Anomalies in X-ray residual stress measurements in cold-rolled steels [AD-A074802]
N80-15239
Evaluation of forgeability of steels by notch compression method [RFP-TRANS-273]
N80-15249
STELLAR WINDS
Lyman alpha initiated winds in late-type stars [NASA-CR-162467]
N80-16008
STERILIZATION
Pathogen reduction in sludges by irradiation [SAND-78-1957C]
N80-15996
STIFFNESS
The effect of initial twist on the torsional rigidity of beams: Another point of view [TAE-360]
N80-15427
STIMULANT
Psychostimulants
N80-15817
STIRLING CYCLE
Sintered silicon nitride recuperator fabrication [NASA-CR-159706]
N80-15263
Free-piston Stirling engine demonstration test plan [COO-2764-T3]
N80-15567
STOCHASTIC PROCESSES
Ray and wave optics of integrable and stochastic systems [LBL-9465]
N80-15921
Stochastic motion of particles in mirror machines [UCRL-82481]
N80-15944
STORAGE BATTERIES
Long-term lithium battery tests [SAND-79-0487]
N80-15608
STORAGE RINGS [PARTICLE ACCELERATORS]
RF power saving in large storage rings [SLAC-TN-79-2]
N80-15353
STORMS [METEOROLOGY]
An analysis of clear air planetary boundary layer wind synthesized from NSSL's dual Doppler-radar data [PB-300865/3]
N80-15755
SESAME [Severe Environmental Storms And Mesoscale Experiment], 1979 plans for operations and data archival — conference [PB-299878/9]
N80-15756
STRATOSPHERE
Man's effect on stratospheric ozone [UCRL-82556]
N80-15666
Mixing in billow turbulence and stratospheric eddy diffusion [AD-A074466]
N80-15715
Stratospheric aerosol modification by supersonic transport operations with climate implications [NASA-RP-1058]
N80-15726
STREAMS
Statistical summaries of Arizona streamflow data [PB-299354/1]
N80-15550
Use of fluvial processes to minimize adverse effects of stream channelization [PB-299934/0]
N80-15552
One-dimensional steady-state stream water-quality model [PB-300327/4]
N80-15677
Estimating the gas and dye quantities for modified tracer technique measurement of stream reaeration coefficients [PB-299015/8]
N80-15690
STRESS [BIOLOGY]
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032]
N80-15527
Use of thermal infrared and colour infrared imagery to detect crop moisture stress — Alberta, Canada [E80-10036]
N80-15530
HCMM/soil moisture experiment — Alberta, Canada [E80-10037]
N80-15531
STRESS [PHYSIOLOGY]
Influence of hypokinesis on physiological functions in fowl [NASA-TM-75999]
N80-15778
Rat reaction to hypokinesia after prior adaptation to hypoxia [NASA-TM-75966]
N80-15782
STRESS ANALYSIS
Thermo-mechanical stress analysis of advanced turbine blade cooling configuration [AD-A074098]
N80-15136
Analysis of a unidirectional composite containing broken fibers and matrix damage [NASA-CR-159185]
N80-15205
Stress-intensity factors and crack-opening displacements for round compact specimens — fracture toughness of metallic materials [NASA-TM-80174]
N80-15430
STRESS CORROSION
Alternate immersion stress corrosion testing of 5083 aluminum [RFP-2645]
N80-15257
STRESS CORROSION CRACKING
Environmental hydrogen cracking of HY steel weld metals [AD-A074104]
N80-15237
STRUCTURAL ANALYSIS
Application of the SIRS concept to Navy helicopters — systems analysis of flight data recorders of flight conditions of helicopters for structural analysis [AD-A074801]
N80-15030
Computer simulation of engine systems [NASA-TM-79290]
N80-15132
General Dynamics Convair Division approach to structural analysis of large superconducting coils [UCRL-13975]
N80-15357
The effect of initial twist on the torsional rigidity of beams: Another point of view [TAE-360]
N80-15427
Unified creep-plasticity model for structural metals at high temperature [ORNL/TM-5969]
N80-15440
Analysis of field test results for single-axis-tracking solar collector foundations [SAND-79-7023]
N80-15586
Finite element method for studying the transient nonlinear thermal creep of geological structures [LA-7883-MS]
N80-15718
STRUCTURAL DESIGN
Quiet Clean Short-haul Experimental Engine [QCSEE]. The aerodynamic and mechanical design of the QCSEE over-the-wing fan [NASA-CR-134915]
N80-15089
Quiet Clean Short-haul Experimental Engine [QCSEE] Over-The-Wing [OTW] boilerplate nacelle design report [NASA-CR-135168]
N80-15099
Structural modeling of a thick-rim rotor [SAND-78-1941C]
N80-15416
Research on the HYLIFE liquid-first-wall concept for future laser fusion reactors [UCRL-15033]
N80-15930
STRUCTURAL DESIGN CRITERIA
Computer simulation of engine systems [NASA-TM-79290]
N80-15132
Low cost aircraft flutter clearance — conference [AGARD-CP-276]
N80-15141
Methodology for determining the configuration of the optimum solar total energy system [SAND-79-0422]
N80-15574

STRUCTURAL ENGINEERING
Composite structural materials
[NASA-CR-162578] N80-15076
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] composite nacelle
[NASA-CR-135352] N80-15119
Very fast, high-peak-power, planar triode amplifiers for driving optical gates
[UCRL-82538] N80-15358
STRUCTURAL MEMBERS
Dynamics of composite materials and elastic structural elements with variable dimensions
[AD-A074592] N80-15206
STRUCTURAL STABILITY
An empirical approach for checking flutter stability of gliders and light aircraft
N80-15144
STRUCTURAL STRAIN
Inelastic analysis of transverse deflection of plates by the boundary element method
[COO-2733-24] N80-15438
STRUCTURAL VIBRATION
Analytical solutions for open nonshallow spherical shell vibrations
[AD-A074269] N80-15434
SUBROUTINES
FLUFLOW: An appended code for calculating heat transfer to a fluid
[SAND-78-8271] N80-15377
Utility and math subroutines for the M6800 microprocessor
[MLM-2564] N80-15847
SUBSONIC FLOW
Summary of advanced methods for predicting high speed propeller performance
[NASA-TM-81409] N80-15051
Fundamental studies of subsonic and transonic flow separation. Part 3: Third phase summary report
[AD-A074068] N80-15057
Unsteady effects of a control surface in two dimensional, subsonic and transonic flow
N80-15168
SUBSONIC SPEED
Aerodynamic characteristics of moving trailing-edge controls at subsonic and transonic speeds
N80-15169
SUDDEN STORM COMMENCEMENTS
The sudden commencement solar proton flux enhancement of 31 October 1972
[AD-A074546] N80-16017
SUGAR CANE
Production of sugarcane and tropical grasses as a renewable energy source
[DOE/CS/3912-T1] N80-15277
SULFATES
Western energy sulfate/nitrate monitoring network
[PB-299238/6] N80-15685
SULFUR COMPOUNDS
Coal sulfur measurements
[PB-299575/1] N80-15294
SUN
Analysis of X-ray and EUV spectra of solar active regions
[NASA-CR-161364] N80-16016
SUNLIGHT
Design and performance of silicon solar cells under concentrated sunlight
[SAND-79-1165C] N80-15577
SUPERCAVITATING FLOW
Leading edge flutter of a supercavitating hydrofoil
[AD-A074636] N80-15301
SUPERCONDUCTING MAGNETS
General Dynamics Convair Division approach to structural analysis of large superconducting coils
[UCRL-13975] N80-15357
Forced two phase helium cooling of large superconducting magnets
[LBL-9701] N80-15373
Superconductivity for mirror fusion
[UCRL-81693] N80-15933
SUPERCONDUCTING POWER TRANSMISSION
Partial discharge performance of lapped plastic insulation for superconducting power transmission cables and the dielectric strength of supercritical helium gas
[BNL-24779] N80-15346
SUPERCONDUCTIVITY
Progress in calculations of the superconducting properties of transition metals
[CONF-790653-4] N80-15242
Superconductivity for mirror fusion
[UCRL-81693] N80-15933
SUPERCONDUCTORS
Superconducting microwave pulse amplifier
[AD-A074056] N80-15331
Propagation of normal zones in thermally insulated superconductors
[CONF-790815-16] N80-15351
Theory of low dimensional superconductors
[SAN-0034-T5] N80-15354
General Dynamics Convair Division approach to structural analysis of large superconducting coils
[UCRL-13975] N80-15357
International activities: The fiscal year 1978 survey of international programs at NEL
[PB-300491/8] N80-16004
SUPERHEATING
Corrosion of several alloys in superheated steam at 482 and 538 deg centigrade
[ORNL/TM-6465] N80-15252
SUPERHIGH FREQUENCIES
Shuttle orbiter S-band payload communications equipment design evaluation
[NASA-CR-160438] N80-15307
SUPERPRESSURE BALLOONS
Diffusion coefficients from Metrac system turbulence measurements
[PB-300339/9] N80-15763
SUPERSONIC CRUISE AIRCRAFT RESEARCH
Flight control and configuration design considerations for highly maneuverable aircraft
N80-15154
SUPERSONIC FLOW
Calculation of two-dimensional inlet flow fields in a supersonic free stream by an implicit marching code with nonorthogonal mesh generation: User's manual
[NASA-CR-3222] N80-15048
A supersonic, three-dimensional code for flow over blunt bodies: User's manual
[NASA-CR-3223] N80-15049
Summary of advanced methods for predicting high speed propeller performance
[NASA-TM-81409] N80-15051
SUPERSONIC INLETS
An analytical and experimental study of a short s-shaped subsonic diffuser of a supersonic inlet
[NASA-TM-81406] N80-15134
Numerical simulation of supersonic inlets using a three-dimensional viscous flow analysis
[NASA-TM-81411] N80-15365
SUPERSONIC JET FLOW
Conceptual design and performance estimates for a supersonic aerodynamic window for the ATA vacuum system aperture
[UCRL-15051] N80-15183
SUPERSONIC TRANSPORTS
Stratospheric aerosol modification by supersonic transport operations with climate implications
[NASA-RP-1058] N80-15726
SUPINE POSITION
Joint Soviet-American experiment on hypokinesia: Experimental results
[NASA-TM-76013] N80-15796
SUPPLYING
The 1985, 1990 and 1995 midterm energy market model results under three scenarios of Fuel Use Act regulations
[DOE/EIA-0182/2] N80-15592
Energy supply and demand in the short term: 1979 and 1980
[DOE/EIA-0184/4] N80-15593
SUPPRESSORS
Comparison of inlet suppressor data with approximate theory based on cutoff ratio
[NASA-TM-81386] N80-15876
SURFACE CRACKS
Environmentally enhanced crazing in polymers
[UCRL-82488] N80-15272
SURFACE DEFECTS
Method of normalizing the measured scattered light from a surface defect located arbitrarily in a Gaussian intensity distribution incident on a surface
[BDX-613-2287] N80-15957
SURFACE ENERGY
Obtaining numerical values for the elliptic emission functions used in calculating electron emission from surfaces
[GEPP-TIS-443] N80-15961
SURFACE FINISHING
Characteristics of thick non-planar SiO2 coatings — surface finishing laser fusion targets
[UCRL-81842] N80-15213
SURFACE PROPERTIES
Aims and accomplishments of surface theory
[SAND-79-1150C] N80-15964
SURFACE REACTIONS
Time-resolved spectroscopic studies of surface reactions
[AD-A074952] N80-15216
Aims and accomplishments of surface theory
[SAND-79-1150C] N80-15964
SURFACE ROUGHNESS
Statistics of optical radiation scattered from rough surfaces
[AD-A074351] N80-15917
SURFACE TEMPERATURE
Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
[E80-10020] N80-15447
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] N80-15527
Use of thermal infrared and colour infrared imagery to detect crop moisture stress — Alberta, Canada
[E80-10036] N80-15530
Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data
[ORO-5444-1] N80-15603
SURFACES
Behavior of vortex systems — kutta-joukowski conditions for vortices over lifting surfaces
N80-15045
SURVEYS
Intensive archeological survey of a potential independent spent fuel storage facility, Savannah River Plant, Aiken and Barnwell Counties, South Carolina, research manuscript series 141
[DOE/SR-01072-1] N80-15914
SWEPT WINGS
Wind tunnel measurements and analysis of some unusual control surfaces on two swept wing fighter configurations
N80-15155
SWITCHING CIRCUITS
Ka-band microwave integrated circuit SPDT switch development
[AD-A074602] N80-15335
SYMMETRY
Linear and nonlinear symmetrically loaded shells of revolution approximated with the finite element method
[LA-7538-MS] N80-15439
SYNCHROTRON RADIATION
Synchrotron radiation: A new tool for biophysical spectroscopy in the visible and ultraviolet
[BNL-24611] N80-15225
SYNCHROTRONS
Prospects for high energy heavy ion accelerators
[LBL-8499] N80-15098
SYNOPTIC METEOROLOGY
Cirrus particle distribution study, part 4
[AD-A074763] N80-15735
Summary of Synoptic Meteorological Observations [SSMO]. Selected South Pacific island marine areas, volume 2. Area 9: Isle Wallis. Area 10: Samoa Islands. Area 11: New Caledonia. Area 12: New Hebrides Islands. Area 13: Fiji Islands. Area 14: Tonga Islands. Area 15: Niue Island. Area 16: Raratonga Island [lower Cook Islands]
[AD-A073446] N80-15745
Summary of Synoptic Meteorological Observations [SSMO]. Selected South Pacific island marine areas, volume 1. Area 1: Nauru Island and Ocean Island. Area 2: Gilbert Islands. Area 3: Canton and Phoenix Islands. Area 4: Christmas and Jarvis Islands. Area 5: Solomon Islands, Northeast. Area 6: Solomon Islands, Southwest. Area 7: Funafuti Atoll. Area 8: Marquesas Islands
[AD-A073445] N80-15746
Application of the zero relative vorticity line in synoptic forecasting
[PB-300790/3] N80-15754
SYNTAX
Limited vocabulary continuous word recognition
[AD-A074206] N80-15309
SYNTHETIC FUELS
High temperature electrolysis — synthetic fuel production
[BNL-26331] N80-15227
Report of the Alcohol Fuel Policy Review
[DOE/PE-0012] N80-15290
Conversion of coal-based methanol to ethylene and a gaseous fuel
[PB-301256/4] N80-15297
SYSTEMS ANALYSIS
Application of the SIRS concept to Navy helicopters — systems analysis of flight data recorders of flight conditions of helicopters for structural analysis
[AD-A074801] N80-15030
Loran digital phase-locked loop and RF front-end system error analysis
[NASA-CR-162731] N80-15065
Design study for ATA vacuum system aperture
[UCRL-15050] N80-15182
Manned geosynchronous mission requirements and systems analysis study. Volume 1: Executive summary
[NASA-CR-160429] N80-15186
LACIE applications evaluation system efficiency report
N80-15473
Functional definition and design of a USDA system
N80-15521
Decentralized solar photovoltaic energy systems
[LA-7866-TASE] N80-15565
Design of photovoltaic systems for residential applications in the United States
[SAND-78-2186C] N80-15566
MARKAL: A multiperiod linear-programming model for energy systems analysis [BNL version]
[BNL-26390] N80-15634
Feasibility of compressed air energy storage as a peak shaving technique in California. Volume 1: Executive summary
[SAN-1331-T2] N80-15636
Solar mechanical energy storage program overview and systems analysis results
[SAND-79-1642C] N80-15637
Analysis to determine functional and systems requirements for an on-line Structure and Composition System [SACS]. Report of task E: Analysis of current and developing systems which interface with LOGSACS and PERSACS to determine to what extent they do or do not support the data requirements of an on-line SACS
[AD-A074638] N80-15868

Technical support for open-cycle MHD program — project planning and systems analysis of a magnetohydrodynamic/steam power system
[ANL/MHD-78-11] N80-15942
SYSTEMS ENGINEERING
Design study of a low cost civil aviation GPS receiver system
[NASA-CR-159176] N80-15062
Aircraft anti-icing/de-icing
[AD-A074128] N80-15079
Design criteria for optimal flight control systems — study of optimal flight control systems engineering for feedback control
[AD-A074092] N80-15139
Manned Orbital Transfer Vehicle [MOTV]. Volume 3: Program requirements documents
[NASA-CR-160431] N80-15188
Solar power satellite system definition study. Volume 1: Executive summary
[NASA-CR-160442] N80-15195
Control systems design for large flexible space structures
[NASA-CR-162502] N80-15301
Coal sulfur measurements
[PB-299575/1] N80-15294
The LACIE data bases: Design considerations
N80-15475
The application test system: Technical approach and system design
N80-15523
Design of photovoltaic systems for residential applications in the United States
[SAND-78-2106C] N80-15566
Methodology for determining the configuration of the optimum solar total energy system
[SAND-79-0422] N80-15574
Flywheel energy storage and conversion system for photovoltaic applications
[COO-4094-48] N80-15635
Power energy for hydrogen production — systems engineering of a process for hydrogen production from nuclear fusion
[BNL-24906] N80-15897
Prospects for high energy heavy ion accelerators
[LBL-8899] N80-15898
Program in wastewater disinfection technology — conference
[PB-299336/4] N80-16001

T

T-28 AIRCRAFT
Techniques employed in the processing of particle size spectra and state parameter data obtained with the T-28 aircraft platform
[PB-299362/4] N80-15771
T-37 AIRCRAFT
Effects of varying visual display characteristics of the T-4G, a T-37 flight simulator
[AD-A071410] N80-15180
TABLES [DATA]
Study of the nature of ozone, oxides of nitrogen, and nonmethane hydrocarbons in Tulsa, Oklahoma. Volume 1: Project description and data summaries
[PB-300481/9] N80-15229
Fast production of methane by anaerobic digestion. Volume 2: Appendices
[COO-2900-17-VOL-2] N80-15283
The 19701A GSRS, missile number 022, round number B-21, 5 Jul. 1979 — weather and meteorological data
[AD-A073391] N80-15739
TAIL ASSEMBLIES
On the effect of wing wake on tail characteristics
N80-15174
TANTALUM
Tantalum fabrication — microstructural analysis
[UCID-18152] N80-15256
TANTALUM CARBIDES
Preparation of unidirectional fiber reinforced tantalum carbide composites
[LA-UR-79-951] N80-15211
TARGET RECOGNITION
The use of classifiers and microprocessors for target identification on using millimeter wave signatures
[AD-A074040] N80-15317
Possible methods for distinguishing icebergs from ships by aerial remote sensing
[NASA-TM-79310] N80-15538
TASKS
Development of the Rocky Mountain Energy and Environmental Technology Center: A preliminary analysis
[ORAU-158] N80-15670
TEA LASERS
The construction and performance of TEAL
[AD-A074746] N80-15391
TECHNOLOGY ASSESSMENT
Technical evaluation report on the 28th Guidance and Control Panel Symposium on Advances in Guidance and Control Systems Using Digital Techniques
[AGARD-AR-148] N80-15140
The YC-14 upper surface blown flap: A unique control surface
N80-15157
Analysis of hydrogen in solids — technology assessment of ways to analyze hydrogen for hydrogen based energy and hydrogen production
[DOE/ER-0026] N80-15220
Commercialization strategy report for recovery of natural gas from unconventional sources
[TID-28840-DRAFT] N80-15287
LACIE applications evaluation system efficiency report
N80-15473
Considerations for design of future research and development interactive image analysis systems
N80-15478
The application test system: Technical approach and system design
N80-15523
A survey of photovoltaic systems
[NASA-CR-150696] N80-15563
Low temperature thermal energy storage: A state-of-the-art survey
[SERI/RR-54-164] N80-15583
Lithium/iron sulfide batteries for electric vehicles
[CONF-781006-2] N80-15611
Near and long term pulse power requirements for laser driven inertial confinement fusion
[UCRL-82661] N80-15938
Toward the endless frontier: History of the Committee on Science and Technology 1959 - 1979
[GPO-35-120] N80-15994
Progress in wastewater disinfection technology — conference
[PB-299338/4] N80-16001
TECHNOLOGY TRANSFER
Functional definition and design of a USDA system
N80-15521
Factors related to the implementation and diffusion of new technologies: A pilot study — effects of government intervention
[PB-298998/6] N80-15978
A research agenda on science and technology for the handicapped
[PB-301220/0] N80-16005
TECHNOLOGY UTILIZATION
Application of Monte Carlo techniques to insolation characterization and prediction
[SERI/RR-36-306] N80-15579
Solar/wind handbook for Hawaii: Technical applications for Hawaii, the Pacific Basin and sites worldwide with similar climatic conditions
[UCRL-15053] N80-15628
Factors related to the implementation and diffusion of new technologies: A pilot study — effects of government intervention
[PB-298998/6] N80-15978
TECTONICS
Physics of mantle and core minerals
[E80-10038] N80-15532
TELEOPERATORS
Teleoperators under the sea
[PB-299883/9] N80-15824
TELEVISION TRANSMISSION
Satellite television in Indonesia
[PB-299524/9] N80-15328
TEMPERATURE DEPENDENCE
Effect of nitrogen concentration on temperature dependent mechanical properties of vanadium
[IS-M-195] N80-15248
Refractory metals for ultrasonic thermometry application
[NUREG-CR-0368] N80-15253
Activation volumes of some superionic conductors with the fluorite structure
[COO-1198-1264] N80-15349
TEMPERATURE GRADIENTS
Directional solidification at ultra-high thermal gradient
[NASA-CR-159797] N80-15300
TEMPERATURE MEASUREMENT
Refractory metals for ultrasonic thermometry application
[NUREG-CR-0368] N80-15253
Limitations of thermocouples in temperature measurements
[CONF-790505-14] N80-15383
Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data
[ORO-5444-1] N80-15603
TEMPERATURE MEASURING INSTRUMENTS
Performance evaluations of the orbisphere laboratories models 2702 and 2709 oxygen measuring systems
[PB-300721/8] N80-15386
TEMPERATURE PROFILES
Northwest New Mexico boundary layer experiment
[LA-7525-MS] N80-15751
TENNESSEE
Applicability of a generic monitoring program for radioactive waste burial grounds at Oak Ridge National Laboratory and Idaho National Engineering Laboratory
[ORNL/SUB-7167-1] N80-15895
TENSILE STRENGTH
High-strength aluminum-magnesium alloys: Thermomechanical processing, microstructure and tensile mechanical properties
[AD-A074185] N80-15238
TEST CHAMBERS
Climatic chamber testing aircraft, engines armament and avionics; Test operations procedure — environmental test chambers and facility for testing aircraft construction materials and engines
[AD-A074049] N80-15181
TEST EQUIPMENT
Impact of new instrumentation on advanced turbine research
[NASA-TM-79301] N80-15133
Test equipment for use in determining classifications of combustible dusts
[PB-300615/2] N80-15231
Evaluation of stationary source particulate measurement methods. Volume 5: Secondary lead smelters
[PB-300337/3] N80-15701
TEST FACILITIES
Climatic chamber testing aircraft, engines armament and avionics; Test operations procedure — environmental test chambers and facility for testing aircraft construction materials and engines
[AD-A074049] N80-15181
Description of the MIT/Lincoln Laboratory photovoltaic systems test facility
[COO-4094-41] N80-15638
TEXAS
The Beryllium-7 program of the Houston area oxidants study
[PB-299632/0] N80-15678
TEXTILES
Energy conservation through point source recycle with high temperature hyperfiltration — textile industry
[PB-299183/4] N80-15688
TEXTS
Study of message text formats: Bibliographic search queries — computer networks for libraries and information services
[ISSN-0160-9742] N80-15981
THEOREM PROVING
Equivalence between resolvent consistency and convergence for nonlinear quasi-contractive algorithms
[ANL-79-51] N80-15863
THERMAL ABSORPTION
Design of residential buildings utilizing natural thermal storage
[DOE/TIC-10143] N80-15302
THERMAL BATTERIES
Thermal model of a thermal battery
[SAND-79-0834] N80-15607
THERMAL BLOOMING
The construction and performance of TEAL
[AD-A074746] N80-15391
THERMAL DIFFUSIVITY
Crystallization, flow and thermal histories of lunar and terrestrial compositions
[NASA-CR-162445] N80-16013
THERMAL EMISSION
Environmental overview of geothermal development: The Geysers-Calistoga KGRA. Volume 1: Issues and recommendations
[UCRL-52496-VOL-1] N80-15626
THERMAL ENERGY
User's manual for computer code SOLTES-1 [Simulator Of Large Thermal Energy Systems]
[SAND-78-1315-REV] N80-15575
Department of Energy large solar central power systems semiannual review
[SAND-78-8511] N80-15601
Aquifer thermal energy storage
[LBL-7070] N80-15618
THERMAL INSULATION
Propagation of normal zones in thermally insulated superconductors
[CONF-790815-16] N80-15351
THERMAL RESISTANCE
Evaluation of hand-held infrared thermometers for wall thermal resistance determinations
[PB-298057/1] N80-15387
THERMAL SIMULATION
Aerodynamic heating on a multi-hundred watt heat source based on wind tunnel tests — for thermal simulation of reentry effects
[AD-A074312] N80-15056
THERMAL STRESSES
A theory of thermoviscoplasticity for uniaxial mechanical and thermal loading
[AD-A074957] N80-15431
Thermal-stress analysis of rock formations for nuclear fuel and waste storage
[UCRL-81992] N80-15910
THERMOCOUPLES
Limitations of thermocouples in temperature measurements
[CONF-790505-14] N80-15383
THERMODYNAMIC EFFICIENCY
Turbine cycle performance improvement through titanium LP blades
[EPRI-AF-903] N80-15417
THERMODYNAMIC EQUILIBRIUM
Correlation and estimation of hydrocarbon vapour-liquid equilibrium constants and application in the calculation of dew- and bubble points of multicomponent mixtures
[PB-300477/7] N80-15230
THERMODYNAMIC PROPERTIES
Aging behavior of alloy 800H and associated mechanical property changes — for nuclear reactors
[GA-A-15194] N80-15251

Isobutane: Provisional thermodynamic functions from 114 to 700 K at pressures to 700 bar
[PB-299361/6] N80-15295
Handbook of lunar materials
[NASA-RP-1057] N80-16009
THERMOMECHANICAL TREATMENT
Thermo-mechanical stress analysis of advanced turbine blade cooling configuration
[AD-A074090] N80-15136
High-strength aluminum-magnesium alloys: Thermomechanical processing, microstructure and tensile mechanical properties
[AD-A074185] N80-15238
THERMOMETERS
Evaluation of hand-held infrared thermometers for wall thermal resistance determinations
[PB-299057/1] N80-15387
THERMOPLASTICITY
Synthesis and characterization of new polyether based soluble polyurethanes
[SAND-78-1866C] N80-15273
A theory of thermoviscoplasticity for uniaxial mechanical and thermal loading
[AD-A074957] N80-15431
THERMOSPHERE
The reaction of the atmosphere to solar disturbances
[NASA-TM-75500] N80-15704
THETA PINCH
Physical conditions in reversed field pinches and theta pinches as inferred from simulations
[LA-UR-79-2368] N80-15937
THICK FILMS
Characteristics of thick non-planar SiO2 coatings — surface finishing laser fusion targets
[UCRL-81842] N80-15213
The effects of substrate composition on thick film circuit reliability
[AD-A074907] N80-15333
THIN FILMS
Study of electronic transport and breakdown in thin insulating films
[AD-A074457] N80-15342
Theory of low dimensional superconductors
[SAN-0034-T5] N80-15354
Corrosion protection of solar-collector heat exchangers with electrochemically deposited films
[COO-4297-1] N80-15569
Semiconductor Measurement Technology: NBS/DOE Workshop, Stability of [Thin Film] Solar Cells and Materials
[PB-299964/7] N80-15644
THOMSON SCATTERING
Stimulated Thomson scattering
[COO-2387-104] N80-15963
THREE DIMENSIONAL BOUNDARY LAYER
The minimum induced drag of aerofoils
[NACA-121] N80-15038
THREE DIMENSIONAL FLOW
A supersonic, three-dimensional code for flow over blunt bodies: User's manual
[NASA-CR-3223] N80-15049
Control of forebody three-dimensional flow separations
N80-15164
Computation of three-dimensional flow in turbofan mixers and comparison with experimental data
[NASA-TM-81410] N80-15364
Numerical simulation of supersonic inlets using a three-dimensional viscous flow analysis
[NASA-TM-81411] N80-15365
A higher order panel method for three-dimensional potential flow
[AD-A074751] N80-15368
A numerical viscous-inviscid interaction algorithm for prediction of near-field VSTOL jet-induced flowfields
[AD-A074070] N80-15370
Numerical procedure for calculating steady/unsteady, single-phase/two-phase three-dimensional fluid flow with heat transfer
[NUREG-CR-0782] N80-15376
THRUST
Liquid oxygen/liquid hydrogen auxiliary power system thruster investigation
[NASA-CR-159674] N80-15202
THUNDERSTORMS
Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
[E80-10020] N80-15447
Storm research
[PB-300299/5] N80-15760
THYRISTORS
An experimental study of the instability of thristor controlled systems
[RAU-EI-74-2-4] N80-15329
TIDES
Analysis and interpretation of tidal currents in the coastal boundary layer — Middle Atlantic Bight
[PB-299428/3] N80-15775
Far-field matching for tidal calculations in near-shore regions
[PB-299016/6] N80-15777
TILT ROTOR AIRCRAFT
NASA/Army XV-15 tilt rotor research aircraft wind-tunnel test program plan — Ames 40-ft by 80-ft wind tunnel tests
[NASA-TM-78562] N80-15067
Quiet powered-lift propulsion
[NASA-CP-2077] N80-15127
TIME SERIES ANALYSIS
Studies in astronomical time series analysis: Modeling random processes in the time domain
[NASA-TM-81148] N80-15854
TIN
Theory of low dimensional superconductors
[SAN-0034-T5] N80-15354
TIRES
Evaluation of particulate emission factors for vehicle tire wear
[PB-300443/9] N80-15702
TIROS SATELLITES
Survey of satellite sensors and data with application to OTEC resource and operations requirements
[PB-300297/9] N80-15543
TISSUES [BIOLOGY]
Mechanism of disorder of plastic processes in tissue during prolonged hypokinesia
[NASA-TM-75955] N80-15799
TITANIUM
Turbine cycle performance improvement through titanium LP blades
[EPRI-AF-903] N80-15417
TITANIUM ALLOYS
Titanium and titanium alloy creep. A bibliography with abstracts
[NTIS/PS-79/0984/9] N80-15260
TITANIUM OXIDES
Theoretical investigation of the excitation structure and optical properties of titanium, vanadium and their oxides
[AD-A074222] N80-15241
TOKAMAK DEVICES
Analysis of the early phase of Tokamak plasma ohmic heating
[WFPS-TME-79-018] N80-15927
Materials experience with Tokamak plasmas
[CONF-790125-54] N80-15943
TOPOGRAPHY
Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
[E80-10020] N80-15447
A preliminary analysis of mesoscale effects of topography on tropical cyclone-associated surface winds
[AD-A074812] N80-15733
TOROIDAL PLASMAS
Theory of drift-wave eigenmodes in toroidal plasmas
[PPPL-1562] N80-15936
TORSIONAL STRESS
CH-46 composite rotor blade flight stress survey data. Volume 3: Plotted forward rotor blade chord, torsion and absolute loads
[AD-A075612] N80-15077
TOXICOLOGY
Toxic polypeptides and uremia
[PB-301063/4] N80-15803
Biological screening of complex samples from industrial/energy processes
[PB-300459/5] N80-15805
TRACE ELEMENTS
Trace element geochemistry of the South Atlantic bight
[DOE/EV-00890-3] N80-15774
TRACKING NETWORKS
LACIE status and tracking
N80-15470
TRAFFIC CONTROL
VTS processing display subsystem design — to prevent environmental damage in harbor areas
[AD-A074053] N80-15830
TRAILING-EDGE FLAPS
Unsteady effects of a control surface in two dimensional, subsonic and transonic flow
N80-15168
Aerodynamic characteristics of moving trailing-edge controls at subsonic and transonic speeds
N80-15169
TRAINING AIRCRAFT
Forebody vortex blowing: A novel control concept to enhance departure/spin recovery characteristics of fighter and trainer aircraft
N80-15172
TRAJECTORY ANALYSIS
Trajectory behaviour of a control configurated aircraft subjected to random disturbances
N80-15171
Detailed description of the HP-9825A HFRMP trajectory processor [TRAJ]
[NASA-CR-160440] N80-15836
TRANSDUCERS
Performance evaluation of a drag-disc turbine transducer and three-beam gamma densitometer under transient two-phase flow conditions
[CONF-790423-15] N80-15384
TRANSFER FUNCTIONS
Geometric design technique for two-dimensional analog and digital filters
[AD-A077963] N80-15334
TRANSFER ORBITS
Simple computations for near-optimum ascent and abort maneuver targets and deorbit ignition time
[NASA-TM-80850] N80-15185
Analysis of GaAs and Si solar cell arrays for earth orbital and orbit transfer missions
[NASA-TM-81383] N80-15204
TRANSFORMATIONS [MATHEMATICS]
Methods for segment wheat area estimation
N80-15491
Generation of uniform chromaticity scale imagery from LANDSAT data
N80-15507
TRANSITION METALS
Progress in calculations of the superconducting properties of transition metals
[CONF-790653-4] N80-15242
Itinerant electron magnetism in 3D-transition metals
[CONF-790730-1] N80-15959
TRANSITION PROBABILITIES
Multiconfiguration Hartree-Fock method for atomic energy levels and transition probabilities
[COO-4264-3] N80-15884
TRANSLATIONAL MOTION
Remarks on the pressure distribution over the surface of an ellipsoid, moving translationally through a perfect fluid
[NACA-TM-196] N80-15041
TRANSMISSION LINES
The effects of primary power transmission lines on the performance of LORAN-C receivers in experimental terrestrial applications
[PB-301367/9] N80-15066
Electromagnetic pulse interaction notes: EMP 3-39
[AD-A074265] N80-15321
TRANSMISSIVITY
Advanced methods for preparation and characterization of infrared detector materials — crystallization and phase diagrams of Hg sub 1-x Cd sub x Te
[NASA-CR-161352] N80-15948
TRANSONIC FLOW
A users guide for A344: A program using a finite difference method to analyze transonic flow over oscillating airfoils
[NASA-CR-159141] N80-15052
Fundamental studies of subsonic and transonic flow separation. Part 3: Third phase summary report
[AD-A074868] N80-15057
Unsteady effects of a control surface in two dimensional, subsonic and transonic flow
N80-15168
TRANSONIC SPEED
Aerodynamic characteristics of moving trailing-edge controls at subsonic and transonic speeds
N80-15169
TRANSPARENCE
Colorimetric consideration of transparencies for a typical LACIE scene
N80-15506
TRANSPORT PROPERTIES
SNEX: Semianalytic solution of the one-dimensional discrete ordinates [S/n] transport equations with diamond differenced angular fluxes
[LA-7879-MS] N80-15856
Geologic factors in nuclear waste disposal — computer simulation of radioactive waste transport from underground storage
[UCRL-52522] N80-15896
TRANSPORTATION NETWORKS
Urban transportation planning, evaluation, and analysis
[PB-300749/9] N80-15999
TRANSVERSE WAVES
Analytic analysis of linear growth rates of gyrotron for TElns mode with zero-temperature beam electrons
[AD-A074368] N80-15397
Inelastic analysis of transverse deflection of plates by the boundary element method
[COO-2733-24] N80-15438
TREMORS
Study on the neuronal circuits implicated in postural tremor and hypokinesia
[NASA-TM-76004] N80-15783
TRIMETHYL COMPOUNDS
The crystal structure and variable temperature Sn-119m Moessbauer study of trimethyltin glycinate, a one-dimensional, amino-bridged polymer
[AD-A074383] N80-15955
TRIODES
A reflex triode with geometric focusing
[AD-A074453] N80-15341
Very fast, high-peak-power, planar triode amplifiers for driving optical gates
[UCRL-82538] N80-15358
TROPICAL METEOROLOGY
TWINDX: A planetary boundary layer model for the winds in extratropical and tropical ocean areas
[AD-A074337] N80-15732
TROPICAL REGIONS
Time and space variation of density in the tropics
[AD-A074472] N80-15714

TROPICAL STORMS
A preliminary analysis of mesoscale effects of topography on tropical cyclone-associated surface winds
[AD-A074812] N80-15733
TROPOSPHERE
The reaction of the atmosphere to solar disturbances
[NASA-TM-75300] N80-15704
Chemical Kinetic Data Needs for Modeling the Lower Troposphere
[PB-299439/0] N80-15722
TUBE HEAT EXCHANGERS
Qualification of aluminum for OTEC heat exchangers
[ANL/OTEC-BCM-003] N80-15573
TUNABLE LASERS
Advanced excitation techniques for tunable infrared lasers
[AD-A076732] N80-15390
Tunable lasers for waste management photochemistry applications
[LA-7113-MS] N80-15402
TURBINE BLADES
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine composite fan blade design report
[NASA-CR-135046] N80-15108
Thermo-mechanical stress analysis of advanced variable blade cooling configuration
[AD-A074099] N80-15136
Computer program for generating input for analysis of impingement-cooled, axial-flow turbine blade
[NASA-TP-1603] N80-15361
Full-coverage film cooling on flat, isothermal surfaces: Data and predictions
[NASA-CR-3219] N80-15363
Turbine cycle performance improvement through titanium LP blades
[EPRI-AF-903] N80-15417
Evaluation of feasibility of prestressed concrete for use in wind turbine blades
[NASA-CR-159725] N80-15553
TURBINE ENGINES
The physical and chemical characterization of an military turbine engine lubricants
[AD-A074073] N80-15265
TURBINE PUMPS
Evaluation of worn SSME low pressure liquid oxygen turbopump bearing
[NASA-CR-161367] N80-15412
TURBINES
Performance evaluation of a drag-disc turbine transducer and three-beam gamma densitometer under transient two-phase flow conditions
[CONF-790423-15] N80-15384
Alternate cycles applied to ocean thermal energy conversion
[SERI/TP-34-180] N80-15571
TURBOFAN ENGINES
Quiet Clean Short-haul Experimental Engine [QCSEE] Over The Wing [OTW] design report
[NASA-CR-134840] N80-15086
Quiet Clean Short-haul Experimental Engine [QCSEE] preliminary under the wing flight propulsion system analysis report
[NASA-CR-134866] N80-15088
Computation of three-dimensional flow in turbofan mixers and comparison with experimental data
[NASA-TM-81410] N80-15364
TURBOFANS
Demonstration of short-haul aircraft aft noise reduction techniques on a twenty inch [50.8 cm] diameter fan, volume 1
[NASA-CR-134849] N80-15083
Demonstration of short-haul aircraft aft noise reduction techniques on a twenty inch [50.8] diameter fan, volume 2
[NASA-CR-134850] N80-15084
Demonstration of short haul aircraft aft noise reduction techniques on a twenty inch [50.8 cm] diameter fan, volume 3
[NASA-CR-134851] N80-15085
Quiet Clean Short-haul Experimental Engine [QCSEE]. The aerodynamic and mechanical design of the QCSEE over-the-wing fan
[NASA-CR-134915] N80-15089
Quiet Clean Short-haul Experimental Engine [QCSEE]. Composite fan frame subsystem test report
[NASA-CR-135010] N80-15098
Quiet Clean Short-haul Experimental Engine [QCSEE]: Hamilton Standard cam/harmonic drive variable pitch fan actuation system detail design report
[NASA-CR-134852] N80-15107
Quiet Clean Short-haul Experimental Engine [QCSEE] composite fan frame design report
[NASA-CR-135279] N80-15110
Quiet Clean Short-haul Experimental Engine [QCSEE] UTW fan preliminary design
[NASA-CR-134842] N80-15111
Quiet Clean Short-haul Experimental Engine [QCSEE]: The aerodynamic and preliminary mechanical design of the QCSEE OTW fan
[NASA-CR-134841] N80-15112
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine composite fan blade design
[NASA-CR-134840] N80-15113
Quiet Clean Short-haul Experimental Engine [QCSEE] whirl test of cam/harmonic pitch change actuation system
[NASA-CR-135148] N80-15117
TURBOJET ENGINES
An extension of engine weight estimation techniques to compute engine production cost
[AD-A074454] N80-15135
TURBOMACHINE BLADES
Impact of new instrumentation on advanced turbine research
[NASA-TM-79301] N80-15133
TURBOMACHINERY
Turbomachinery options for an underground pumped hydroelectric storage plant
[CONF-790803-50] N80-15629
TURBULENT BOUNDARY LAYER
Applications of modern hydrodynamics to aeronautics. Part 1: Fundamental concepts and the most important elements. Part 2: Applications
[NACA-116] N80-15034
Experimental study of combustion in a turbulent boundary layer
[LBL-8946] N80-15218
TURBULENT DIFFUSION
Mixing in billow turbulence and stratospheric eddy diffusion
[AD-A074466] N80-15715
TURBULENT FLOW
On the effect of wing wake on tail characteristics N80-15174
Combustion noise
[NASA-CR-162571] N80-15215
Calculation of plane sudden expansion flow via vortex dynamics
[SAND-79-8679] N80-15374
TURBULENT MIXING
Computation of three-dimensional flow in turbofan mixers and comparison with experimental data
[NASA-TM-81410] N80-15364
Mixing in billow turbulence and stratospheric eddy diffusion
[AD-A074466] N80-15715
TWISTING
The effect of initial twist on the torsional rigidity of beams: Another point of view
[TAE-360] N80-15427
TWO DIMENSIONAL BODIES
Modifying the GNATS mesh generation code to improve the modeling of branched structures
[IC/CSD/TM-26] N80-15444
TWO DIMENSIONAL FLOW
General potential theory of arbitrary wing sections
[NACA-452] N80-15046
Calculation of two-dimensional inlet flow fields in a supersonic free stream by an implicit marching code with nonorthogonal mesh generation: User's manual
[NASA-CR-3222] N80-15048
Unsteady effects of a control surface in two dimensional, subsonic and transonic flow N80-15168
Characterization of acoustic disturbances in linearly sheared flows
[NASA-CR-162577] N80-15869
TWO PHASE FLOW
Two-phase vapour-liquid flow with phase change, review
[PB-299905] N80-15379
Performance evaluation of a drag-disc turbine transducer and three-beam gamma densitometer under transient two-phase flow conditions
[CONF-790423-15] N80-15384
Analytical models and experimental studies of centrifugal-pump performances in two-phase flow — light water reactor coolant pumps
[EPRI-NP-677] N80-15415

U

U.S.S.R.
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE N80-15482
LACIE area, yield, and production estimate characteristics: U.S.S.R. N80-15485
ULTRAHIGH FREQUENCIES
Design of the digital control and test unit subsystems for a satellite signal analyzer
[AD-A073928] N80-15313
ULTRASONIC TESTS
Long-term erosion monitoring of metallic conduits by ultrasonic pulse-echo techniques — components of coal gasification and liquefaction pilot plants
[CONF-790480-1] N80-15259
Microcomputer-controlled ultrasonic data acquisition system
[ORNL/TM-6531] N80-15877
ULTRAVIOLET RADIATION
Sympathetic breakdown on gaps in air
[SAND-79-0598C] N80-15355
Prospects of using large vacuum photodiodes with gas scintillation proportional counters
[LA-UR-79-1246] N80-15382
Influence of clouds on UV-B penetration to the earth's surface
[NASA-CR-160428] N80-15703
ULTRAVIOLET SPECTRA
Analysis of X-ray and EUV spectra of solar active regions
[NASA-CR-161364] N80-16016
ULTRAVIOLET SPECTROPHOTOMETERS
Dobson spectrophotometer ozone measurements during international ozone rocketsonde intercomparison
[NASA-TM-73284] N80-15727
ULTRAVIOLET SPECTROSCOPY
Synchrotron radiation: A new tool for biophysical spectroscopy in the visible and ultraviolet
[BNL-24811] N80-15225
Airborne measurements of solar and planetary near ultraviolet radiation during the NASA/ESA CV-900 spacelab simulation
[NASA-CR-162566] N80-16012
UNDERGROUND STORAGE
Heat transfer studies in salt and granite
[ORNL/ENG/TM-14] N80-15581
Turbomachinery options for an underground pumped hydroelectric storage plant
[CONF-790803-50] N80-15629
Seismic safety in nuclear-waste disposal
[UCID-18125] N80-15894
Applicability of a generic monitoring program for radioactive waste burial grounds at Oak Ridge National Laboratory and Idaho National Engineering Laboratory
[ORNL/SUB-7167-1] N80-15895
Geologic factors in nuclear waste disposal — computer simulation of radioactive waste transport from underground storage
[UCRL-52522] N80-15896
Rock mass characterization for storage of nuclear waste in granite
[LBL-8570] N80-15911
UNDERWATER ACOUSTICS
The effect of inaccuracies in meteorological parameters on one-dimensional forecasts of upper ocean thermal structure
[AD-A073539] N80-15748
UNDERWATER ENGINEERING
Model task for the dynamics of an underwater two-legged walker
[NASA-TM-75697] N80-15822
UNDERWATER VEHICLES
Teleoperators under the sea
[PB-299883/9] N80-15824
UNIFORM FLOW
Pressure fluctuations on the surface of a cylinder in uniform flow
[NASA-CR-162468] N80-15362
UNITED STATES OF AMERICA
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
LACIE large area acreage estimation — United States of America N80-15453
Accuracy assessment: The statistical approach to performance evaluation in LACIE — Great Plains corridor, United States N80-15459
LACIE area, yield, and production estimate characteristics: U.S. Great Plains N80-15484
Accuracy and performance of LACIE area estimates — wheat yield in the U.S. Great Plains States N80-15487
Input data for solar systems
[DOE/TIC-10193] N80-15580
Federal Energy Data System [FEDS] statistical summary update
[DOE/EIA-0192] N80-15630
Western energy sulfate/nitrate monitoring network
[PB-299238/6] N80-15685
UNSTEADY FLOW
Unsteady effects of a control surface in two dimensional, subsonic and transonic flow N80-15168
Numerical procedure for calculating steady/unsteady, single-phase/two-phase three-dimensional fluid flow with heat transfer
[NUREG-CR-0782] N80-15376
UNSWEPT WINGS
A flutter-speed formula for wings of high aspect ratio N80-15147
UPPER SURFACE BLOWN FLAPS
Exploratory studies of the cruise performance of upper surface blown configuration: Experimental program, high-speed force tests
[NASA-CR-159134] N80-15070
Exploratory studies of the cruise performance of upper surface blown configurations: Experimental program, high-speed pressure tests
[NASA-CR-159135] N80-15071
Exploratory studies of the cruise performance of upper surface blown configurations: Program analysis and conclusions
[NASA-CR-159136] N80-15072
UPWELLING WATER
Atmospheric structural variations that result in upwelling off Oregon
[PB-301240/8] N80-15768

URANIUM
Single-stage mass spectrometric analyses of resin bead samples
[ORNL/TM-6563] N80-15224
URBAN PLANNING
Urban transportation planning, evaluation, and analysis
[PB-300749/9] N80-15999
URBAN TRANSPORTATION
Urban transportation planning, evaluation, and analysis
[PB-300749/9] N80-15999
New transportation systems and technology, 1979: Transportation research record 708
[PB-300747/3] N80-16000
A methodology for evaluating the effectiveness of transportation improvements for the elderly and handicapped
[PB-300440/5] N80-16007
UROLOGY
Toxic polypeptides and uremia
[PB-301063/4] N80-15803
USER MANUALS (COMPUTER PROGRAMS)
Calculation of two-dimensional inlet flow fields in a supersonic free stream by an implicit marching code with nonorthogonal mesh generation: User's manual
[NASA-CR-3222] N80-15048
A supersonic, three-dimensional code for flow over blunt bodies: User's manual
[NASA-CR-3223] N80-15049
User's guide for a system of computer programs to predict flows over and in the near wake behind axisymmetric, self-propelled bodies
[AD-A074972] N80-15372
User's manual for computer code SOLTES-1 [Simulator Of Large Thermal Energy Systems]
[SAND-78-1315-REV] N80-15575
Interactive Environmental Impact Computer System [EICS] user manual
[AD-A074890] N80-15662
Detailed description of the HP-9825A HFRMP trajectory processor [TRAJ]
[NASA-CR-160440] N80-15836
Rationale for the design of the ADA programming language: Volume 14, no. 6, part B
[AD-A073854] N80-15842
The FLEX system: User and caretaker's manual
[AD-A073997] N80-15844
REBEL/BASIC: Language, a user's guide
[UCRL-52668] N80-15849
Common file system reference manual, PIM-5
[LA-5525-M-VOL-5] N80-15988
USER REQUIREMENTS
The application test system: An approach to technology transfer — USDA aerospace and remote sensing information requirements
N80-15520
A methodology for evaluating the effectiveness of transportation improvements for the elderly and handicapped
[PB-300440/5] N80-16007

V

VACUUM SYSTEMS
Design study for ATA vacuum system aperture
[UCRL-15050] N80-15182
Conceptual design and performance estimates for a supersonic aerodynamic window for the ATA vacuum system aperture
[UCRL-15051] N80-15183
VACUUM TUBES
Displacement characteristics of a glass-ceramic insulator in a vacuum tube envelope sealing process
[GEPP-TIS-445] N80-15269
VANADIUM
Effect of nitrogen concentration on temperature dependent mechanical properties of vanadium
[IS-M-195] N80-15248
VANADIUM OXIDES
Theoretical investigation of the excitation structure and optical properties of titanium, vanadium and their oxides
[AD-A074222] N80-15241
VAPOR PHASES
Simulation of LNG vapor spread and dispersion by finite element methods
[UCRL-82441] N80-15282
Forced two phase helium cooling of large superconducting magnets
[LBL-9701] N80-15373
VAPOR PRESSURE
Liquid-liquid contact in vapor explosion
[ANL/RAS-78-37] N80-15285
VARACTOR DIODES
Two-pole varactor-tuned helical resonator filters
[AD-A074476] N80-15332
VARIABLE PITCH PROPELLERS
Quiet Clean Short-haul Experimental Engine [QCSEE]. Aerodynamic and aeromechanical performance of a 50.8 cm [20 inch] diameter 1.34 PR variable pitch fan with core flow
[NASA-CR-135017] N80-15087
VARIANCE (STATISTICS)
Multiyear estimates for the LACIE sampling plans
N80-15517
VECTORS (MATHEMATICS)
MIE scattering calculations, advances in technique and fast, vector-shaped computer codes
[PB-301388/5] N80-15923
VEGETATION
Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data
[NASA-TP-1553] N80-15535
VELOCITY DISTRIBUTION
Remote sensing of crosswind profiles using the correlation slope method
[AD-A074644] N80-15541
VENUS ATMOSPHERE
The chemistry of Venus' atmosphere
[NASA-CR-159951] N80-16011
VERTICAL TAKEOFF AIRCRAFT
A numerical viscous-inviscid interaction algorithm for prediction of near-field VSTOL jet-induced flowfields
[AD-A074070] N80-15370
VERY LOW FREQUENCIES
VLF/LF reflexivity of the polar ionosphere, 23 April - 2 September 1978
[AD-A074762] N80-15318
VIBRATION
Physical forces generating acceleration, vibration, and impact — physiological effects
N80-15792
VIBRATION TESTS
A simplified ground vibration test procedure for sailplanes and light aircraft
N80-15146
Scale modeling of finite length fluid annular gaps for flow-induced vibration testing
[ANL-CT-79-40] N80-15436
VIDEO DATA
Problems in processing multisensal video information at specialized complexes
[NASA-TM-75919] N80-15837
VIDICONS
Software techniques for the acquisition of optical data from a minicomputer-based image-intensifier-vidicon system
[AD-A074844] N80-15838
VIRIAL THEOREM
Isobutane: Provisional thermodynamic functions from 114 to 700 K at pressures to 700 bar
[PB-299361/6] N80-15295
VISCOELASTICITY
Wave propagation in viscoelastic media
[UCRL-83019] N80-15378
VISCOPLASTICITY
A theory of thermoviscoplasticity for uniaxial mechanical and thermal loading
[AD-A074957] N80-15431
VISCOSITY
Apparent viscosities of setting elastomers — dental materials
[AD-A074843] N80-15267
VISCOUS FLOW
Numerical simulation of supersonic inlets using a three-dimensional viscous flow analysis
[NASA-TM-81411] N80-15365
Crystallization, flow and thermal histories of lunar and terrestrial compositions
[NASA-CR-162445] N80-16013
VISIBILITY
An analysis of atmospheric visibility data in the Houston area
[PB-299633/8] N80-15680
VISION
Special session on vision
[LBL-9160] N80-15802
VISUAL ACUITY
Daytime visual acuity of observers through a window with and without binoculars
[AD-A074722] N80-15800
VISUAL FIELDS
Visual accomodation responses in a virtual image environment
[AD-A074415] N80-15082
VISUAL PERCEPTION
Visual accomodation responses in a virtual image environment
[AD-A074415] N80-15082
Special session on vision
[LBL-9160] N80-15802
VISUAL TASKS
Hypnotics and the management of disturbed sleep
N80-15818
VLASOV EQUATIONS
Two-stream instability for a scattered beam propagating in a collisional plasma
[LA-UR-79-1687] N80-15945
VOICE COMMUNICATION
Narrowband voice system
[AD-A074445] N80-15314
HF modem evaluations for the Advanced Narrowband Digital Voice Terminal [ANDVT]
[AD-A073674] N80-15323
VOLCANOES
Geothermal energy development from the Salton Trough to the High Cascades — Cerro Preto, Lower California and Mt. Hood, Oregon
[LBL-8703] N80-15568
VORTEX GENERATORS
Some investigations concerning the effects of gaps and vortex generators on elevator efficiency and of landing flap sweep on aerodynamic characteristics
N80-15178
VORTEX RINGS
Dynamics of vortices and shock waves in nonuniform media
[AD-A072842] N80-15366
VORTICES
The mechanism of fluid resistance
N80-15035
Behavior of vortex systems — kutta-joukowski condition for vortices over lifting surfaces
N80-15045
Forebody vortex blowing: A novel control concept to enhance departure/spin recovery characteristics of fighter and trainer aircraft
N80-15172
Dynamics of vortices and shock waves in nonuniform media
[AD-A072842] N80-15366
Calculation of plane sudden expansion flow via vortex dynamics
[SAND-79-8679] N80-15374
VORTICITY
Application of the zero relative vorticity line in synoptic forecasting
[PB-300790/3] N80-15754

W

WAKEFULNESS
Sleep, Wakefulness and Circadian Rhythm
[AGARD-LS-105] N80-15806
Vigilance and attention
N80-15811
Biological rhythms of man living in isolation from time cues
N80-15813
WAKES
On the effect of wing wake on tail characteristics
N80-15174
WALKING MACHINES
Model task for the dynamics of an underwater two-legged walker
[NASA-TM-75697] N80-15822
WALL PRESSURE
Pressure fluctuations on the surface of a cylinder in uniform flow
[NASA-CR-162466] N80-15362
WALL TEMPERATURE
Evaluation of hand-held infrared thermometers for wall thermal resistance determinations
[PB-298057/1] N80-15387
WARNING SYSTEMS
Some human factors issues in the development and evaluation of cockpit alerting and warning systems
[NASA-RP-1055] N80-15821
WASHINGTON
A program of management and technical assistance in the state of Washington — in support of economic growth
[PB-299276/6] N80-15977
WASTE DISPOSAL
Management of coal preparation fine wastes without disposal ponds
[PB-299100/8] N80-15691
Seismic safety in nuclear-waste disposal
[UCID-18125] N80-15894
Geologic factors in nuclear waste disposal — computer simulation of radioactive waste transport from underground storage
[UCRL-52522] N80-15896
Technical concept for a test of geologic storage of spent reactor fuel in the climax granite, Nevada Test Site
[UCRL-52796] N80-15899
Public policy issues in nuclear waste management
[PNL-2743] N80-15903
Environmental surveillance report for the INEL radioactive waste management complex
[TREE-1357] N80-15909
Thermal-stress analysis of rock formations for nuclear fuel and waste storage
[UCRL-81992] N80-15910
Rock mass characterization for storage of nuclear waste in granite
[LBL-8570] N80-15911
Shallow land burial: Experience and developments at Oak Ridge and Los Alamos
[LA-UR-79-1039] N80-15912
Intensive archeological survey of a potential defense waste processing facility site, Savannah River Plant, Aiken and Barnwell Counties, South Carolina. Research manuscript series 149
[DOE/SR-01072-3] N80-15913
WASTE ENERGY UTILIZATION
Utilization of waste heat from Federal facilities
[ORO-5523-T1] N80-15590
Aquifer thermal energy storage
[LBL-7070] N80-15618
Characterization of operating conditions for gas/water heat recovery steam generators
[ORNL/TM-6622] N80-15620

Analysis of potential implementation levels for waste heat utilization in the nuclear power industry
[ORNL/TM-63-2] N80-15625

WASTE TREATMENT

Tunable lasers for waste management photochemistry applications
[LA-7113-MS] N80-15402

Pathogen reduction in sludges by irradiation
[SAND-78-1957C] N80-15996

Institutional barriers to wastewater reuse
[PB-299027/3] N80-16002

WASTE UTILIZATION

Conversion of cellulosic and waste polymer material to gasoline
[COO-2912-39] N80-15291

Energy optimal use of waste paper
[COO-2893-9] N80-15395

WASTE WATER

Energy conservation through point source recycle with high temperature hyperfiltration — textile industry
[PB-299183/4] N80-15688

Effect of infrared radiation on compaction of municipla wastewater sludges
[PB-298294/7] N80-15998

Institutional barriers to wastewater reuse
[PB-299027/3] N80-16002

Performance evaluation of the existing three lagoon wastewater treatment plant at Pawnee, Illinois
[PB-299740/1] N80-16006

WATER

Performance evaluations of the orbisphere laboratories models 2702 and 2709 oxygen measuring systems
[PB-300721/9] N80-15386

WATER DEPTH

Technical papers on airborne laser hydrography
[PB-299321/4] N80-15546

WATER EROSION

Watershed erosion and sediment transport model
[PB-299070/3] N80-15551

WATER FLOW

Statistical summaries of Arizona streamflow data
[PB-299354/1] N80-15550

Use of fluvial processes to minimize adverse effects of stream channelization
[PB-299934/0] N80-15552

WATER POLLUTION

Environmental assessment report: Solvent Refined Coal [SRC] systems
[PB-300203/7] N80-15676

One-dimensional steady-state stream water-quality model
[PB-300327/4] N80-15677

American-Soviet Symposium on Chemical Pollution of the Marine Environment, 1st
[PB-298343/5] N80-15683

The cost of clean air and water report to Congress
[PB-300446/2] N80-15693

Quantity and quality of urban runoff from three localities in the Denver metropolitan area, Colorado
[PB-299859/9] N80-15698

WATER QUALITY

Use of indicator species of algae to determine water quality
[PB-299953/0] N80-15694

WATER RECLAMATION

Institutional barriers to wastewater reuse
[PB-299027/3] N80-16002

WATER RESOURCES

Heat Capacity Mapping Mission [HCMM]
[E80-10039] N80-15533

Water use alternatives for Navajo energy production
[LA-UR-79-1998] N80-15643

WATER TREATMENT

An evaluation of activated carbon for drinking water treatment
[PB-299968/8] N80-15228

Field and laboratory studies for the development of effluent standards for the steam electric power industry
[PB-299097/6] N80-15689

Performance evaluation of the existing three lagoon wastewater treatment plant at Pawnee, Illinois
[PB-299740/1] N80-16006

WATER VAPOR

Precipitable water over the United States. Volume 2: Semimonthly maxima
[PB-300870/3] N80-15753

WATER WAVES

Correlation between wave slopes and near-surface ocean currents
[BNL-25046] N80-15773

WATERSHEDS

Watershed erosion and sediment transport model
[PB-299070/3] N80-15551

WAVE FUNCTIONS

Scaled hydrogenic approximation wave functions
[UCID-18167] N80-15881

WAVE INTERACTION

Correlation between wave slopes and near-surface ocean currents
[BNL-25046] N80-15773

WAVE PROPAGATION

Steady-state point-source excitation of a laminated composite
[AD-A074336] N80-15207

Shock propagation in the three-dimensional lattice. 2: Method of calculation
[AD-A074263] N80-15316

Wave propagation in viscoelastic media
[UCRL-83019] N80-15378

Characterization of acoustic disturbances in linearly sheared flows
[NASA-CR-162577] N80-15869

Velocity model of the shallow lunar crust
[NASA-CR-162573] N80-16014

WAVE SCATTERING

Method of optimal truncation: A new t-matrix approach to elastic wave scattering
[LA-UR-79-1954] N80-15324

WAVEGUIDES

Investigation of microwave circuits that are suitable for application to integrate with the Pound-Leibys' silicon millimeter wave tube
[AD-A074984] N80-15925

WEAR

Long-term erosion monitoring of metallic conduits by ultrasonic pulse-echo techniques — components of coal gasification and liquefaction pilot plants
[CONF-790480-1] N80-15259

Evaluation of worn SSME low pressure liquid oxygen turbopump bearing
[NASA-CR-161367] N80-15412

Evaluation of 100 mm bore bearings after accelerated testing in a simulated space environment
[AD-A074527] N80-15413

Evaluation of particulate emission factors for vehicle tire wear
[PB-300443/9] N80-15702

WEATHER

Input data for solar systems
[DOE/TIC-10193] N80-15580

Edwards AFB, Lancaster, California, Revised Uniform Summary of Surface Weather Observations [RUSSWO]
[AD-A074691] N80-15734

The 1702A GSRS, missile number 306, round number B-26, *9 July 1979* — weather and meteorological data
[AD-A073394] N80-15736

The 19702A GSRS, missile number 321, round number B-25, *9 July 1979* — weather and meteorological data
[AD-A073393] N80-15738

The 19701A GSRS, missile number 022, round number B-21, *5 Jul. 1979* — weather and meteorological data
[AD-A073391] N80-15739

The 14822B Lance, missile number 4390, round number 334-AST — weather and meteorological data
[AD-A073387] N80-15741

The 19304DT GSR, missile numbers 1070 and 1048, round numbers V-47 and V-48, *28 June 1979* — weather and meteorological data
[AD-A073389] N80-15742

The 19304B GSRS, missile numbers 1029, 1050, 1054, 1073, 1074, 1056, round numbers V-49, V-50, V-51, V-52, V-53, V-54, *2 July 1979* — weather and meteorological data
[AD-A073390] N80-15743

Summary of Synoptic Meteorological Observations [SSMO]. Selected South Pacific island marine areas, volume 2. Area 9: Isle Wallis. Area 10: Samoa Islands. Area 11: New Caledonia. Area 12: New Hebrides Islands. Area 13: Fiji Islands. Area 14: Tonga Islands. Area 15: Niue Island. Area 16: Rarotonga Island [Iower Cook Islands]
[AD-A073446] N80-15745

WEATHER FORECASTING

Topographical characteristics through the study of *the thermal and hydrological dissuniformity of the soil* from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
[E80-10020] N80-15647

Investigation of models for large-scale meteorological prediction experiments
[NASA-CR-162572] N80-15728

Application of the zero relative vorticity line in synoptic forecasting
[PB-300790/3] N80-15754

Low-level wind shear: A critical review — aviation safety
[PB-300715/0] N80-15764

WEATHER MODIFICATION

Meteorological effects of oil refinery operations in Los Angeles
[PB-300720/0] N80-15758

WEATHERPROOFING

Project evaluation and quality control — weatherization
[PB-301048/5] N80-15647

WEIGHTING FUNCTIONS

Weighted aggregation N80-15518

WEIGHTLESSNESS

Weightlessness — physiological effects N80-15795

WELD STRENGTH

Environmental hydrogen cracking of HY steel weld metals
[AD-A074104] N80-15237

Nitrogen-strengthened austenitic stainless steel for cryogenic magnet structures
[CONF-790815-13] N80-15258

WELDING

Laser welding. Citations from the Engineering Index data base — bibliography with abstracts
[NTIS/PS-79/1021/4] N80-15418

WETLANDS

Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 — Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] N80-15526

Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data
[NASA-TP-1553] N80-15535

WHEAT

Proceedings of Technical Session, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448

Sampling, aggregation, and variance estimation for area, yield, and production in LACIE N80-15449

Econometric models for predicting confusion crop ration N80-15450

LACIE sampling design N80-15451

LACIE large area acreage estimation — United States of America N80-15453

Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts — wheat N80-15454

Classification and mensuration of LACIE segments N80-15455

Development of LACIE CCEA-1 weather/wheat yield models — regression analysis N80-15457

Growth stage estimation — crop calendars N80-15458

Accuracy assessment: The statistical approach to performance evaluation in LACIE — Great Plains corridor, United States N80-15459

Ancillary data acquisition for LACIE N80-15462

The classification and mensuration subsystem — wheat N80-15465

Concepts leading to the IMAGE-100 hybrid interactive system N80-15466

USDA analyst review of the LACIE IMAGE-100 hybrid system test N80-15467

Accuracy assessment system and operation N80-15472

The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE N80-15482

LACIE area, yield, and production estimate characteristics: U.S. Great Plains N80-15484

LACIE area, yield, and production estimate characteristics: U.S.S.R. N80-15485

LACIE area, yield, and production estimate characteristics: Canada N80-15486

Accuracy and performance of LACIE area estimates — wheat yield in the U.S. Great Plains States N80-15487

Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world N80-15488

Accuracy and performance of LACIE crop development models N80-15489

Methods for segment wheat area estimation N80-15491

Development of partitioning as an aid to spectral signature extension N80-15499

The vegetative index number and crop identification N80-15503

LACIE analyst interpretation keys N80-15505

Status of yield estimation technology: A review of second-generation model development and evaluation N80-15510

A universal model for estimating wheat yields
[CONTRIB-78-268-A] N80-15511

The law of the minimum and an application to wheat yield estimation N80-15512

CCEA second-generation wheat yield model for hard red wheat in North Dakota N80-15513

Prediction of wheat phenological development: A state-of-the-art review N80-15514

Analysis of scanner data for crop inventories — North Dakota
[E80-10040] N80-15534

WIND [METEOROLOGY]
TWINDX: A planetary boundary layer model for the winds in extratropical and tropical ocean areas
[AD-A074337] N80-15732
The 1970IA GSRS, missile numbers 304, 305, 307, round numbers B-22, B-23, B-24, 5 July 1979
[AD-A073392] N80-15737
An analysis of clear air planetary boundary layer wind synthesized from NSSL's dual Doppler-radar data
[PB-300865/7] N80-15725
WIND MEASUREMENT
Evaluation of the saturation resistant crosswind sensor
[AD-A074276] N80-15731
The 1970IA GSRS, missile number 022, round number B-21, 5 Jul. 1979 — weather and meteorological data
[AD-A073391] N80-15739
WIND PROFILES
Remote sensing of crosswind profiles using the correlation slope method
[AD-A074846] N80-15541
A preliminary analysis of mesoscale effects of topography on tropical cyclone-associated surface winds
[AD-A074812] N80-15733
Northwest New Mexico boundary layer experiment
[LA-7525-MS] N80-15751
WIND SHEAR
Low-level wind shear: A critical review — aviation safety
[PB-300715/0] N80-15764
WIND TUNNEL MODELS
Wind tunnel investigation of controls for DF on a fighter-type configuration of higher angles of attack
N80-15166
WIND TUNNEL TESTS
Aerodynamic heating on a multi-hundred watt heat source based on wind tunnel tests — for thermal simulation of reentry effects
[AD-A074312] N80-15096
NASA/Army XV-15 tilt rotor research aircraft wind-tunnel test program plan — Ames 40-ft by 80-ft wind tunnel tests
[NASA-TM-78562] N80-15067
Correlation of F-15 flight and wind tunnel test control effectiveness
N80-15152
Some wind tunnel measurements of the effectiveness at low speeds of combined lift and roll controls
N80-15153
Fin design with ACT in the presence of strakes
N80-15161
An experimental study of the structure and acoustic field of a jet in a cross stream — Ames 7-ft by 10-ft wind tunnel tests
[NASA-CR-162464] N80-15871
WIND VELOCITY
The effect of inaccuracies in meteorological parameters on one-dimensional forecasts of upper ocean thermal structure
[AD-A073539] N80-15748
Arizona cool season climatological surface wind and pressure gradient study
[PB-299900/2] N80-15762
WIND VELOCITY MEASUREMENT
System considerations of a long range coherent lidar wind sensor with particular emphasis on real weather effects
[PB-299972/0] N80-15757
Error characteristics of satellite-derived winds
[PB-300754/9] N80-15759
WINDMILLS [WINDPOWERED MACHINES]
Evaluation of feasibility of prestressed concrete for use in wind turbine blades
[NASA-CR-159725] N80-15553
WINDOWS [APERTURES]
Design study for ATA vacuum system aperture
[UCRL-15050] N80-15182
Conceptual design and performance estimates for a supersonic aerodynamic window for the ATA vacuum system aperture
[UCRL-15051] N80-15183
WINDPOWER UTILIZATION
Solar/wind handbook for Hawaii: Technical applications for Hawaii, the Pacific Basin and sites worldwide with similar climatic conditions
[UCRL-15053] N80-15628
WING FLAPS
Fluperon control: The versatile surface for fighter aircraft
N80-15158
WING FLOW METHOD TESTS
Separation jump and sudden stall over an ellipsoidal wind at incidence — wing flow method tests for investigating laminar boundary layer, boundary layer transition, and separated flow
[AD-A074260] N80-15054
WING PANELS
Elements of the wing section theory and of the wing theory
[NACA-191] N80-15040
Loading tests of a wing structure for a hypersonic aircraft
[NASA-TP-1596] N80-15068
WING PROFILES
General potential theory of arbitrary wing sections
[NACA-452] N80-15046
General theory of aerodynamic instability and the mechanism of flutter
[NACA-496] N80-15047
WING SLOTS
Some investigations concerning the effects of gaps and vortex generators on elevator efficiency and of landing flap sweep on aerodynamic characteristics
N80-15178
WINGS
Elements of the wing section theory and of the wing theory
[NACA-191] N80-15040
A parametric wing design study for a modern laminar flow wing
[NASA-TM-80154] N80-15050
Separation jump and sudden stall over an ellipsoidal wind at incidence — wing flow method tests for investigating laminar boundary layer, boundary layer transition, and separated flow
[AD-A074260] N80-15054
JA-6A circulation control wing contractor flight demonstration
[AD-A074888] N80-15080
Aerodynamic interaction on a close-coupled canard wing configuration
N80-15175
WIRE CLOTH
Review of water intake screening options for coastal water users with recommendations for Ocean Thermal Energy Conversion (OTEC) plants
[ANL/OTEC-BCM-005] N80-15572
WORDS [LANGUAGE]
Limited vocabulary continuous word recognition
[AD-A074206] N80-15309
WORK-REST CYCLE
Tolerance to shift work: A chronologic approach
N80-15815

X

X RAY ANALYSIS
The application of image processing to the detection of corrosion by radiography
[ARL/MAT-REPT-109] N80-15421
X RAY DIFFRACTION
Characteristics of thick non-planar SiO2 coatings — surface finishing laser fusion targets
[UCRL-81942] N80-15213
Anomalies in X-ray residual stress measurements in cold-rolled steels
[AD-A074802] N80-15239
X RAY IMAGERY
Imaging X-ray spectrometer to study solar activity in conjunction with the SCADM program
[LA-UR-79-1921] N80-16019
X RAY SOURCES
Micro-fresnel structures for microscopy of laser generated bright X-ray sources
[UCRL-82684] N80-15401
X RAY SPECTRA
Analysis of X-ray and EUV spectra of solar active regions
[NASA-CR-161364] N80-16016
X RAY SPECTROSCOPY
Imaging X-ray spectrometer to study solar activity in conjunction with the SCADM program
[LA-UR-79-1921] N80-16019

Y

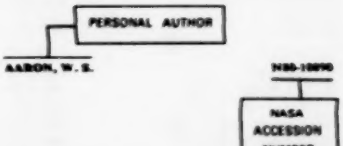
YC-14 AIRCRAFT
Quiet powered-lift propulsion
[NASA-CP-2077] N80-15127
The YC-14 upper surface blown flap: A unique control surface
N80-15157
YIELD
Proceedings of Technical Session, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
Sampling, aggregation, and variance estimation for area, yield, and production in LACIE
N80-15449
Econometric models for predicting confusion crop ratios
N80-15450
Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts — wheat
N80-15454
Development of LACIE CCEA-1 weather/wheat yield models — regressive analysis
N80-15457
Operation of the yield estimation subsystem
N80-15468
The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports
N80-15469
LACIE area, yield, and production estimate characteristics: U.S. Great Plains
N80-15484
LACIE area, yield, and production estimate characteristics: U.S.S.R.
N80-15485
LACIE area, yield, and production estimate characteristics: Canada
N80-15486
Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world
N80-15488
Status of yield estimation technology: A review of second-generation model development and evaluation
N80-15510
A universal model for estimating wheat yields
[CONTRIB-78-268-A] N80-15511
The law of the minimum and an application to wheat yield estimation
N80-15512
CCEA second-generation wheat yield model for hard red wheat in North Dakota
N80-15513

Z

ZETA PINCH
Global properties of ohmically heated reversed-field pinches
[LA-UR-79-2346] N80-15934
Plasma crowbars in cylindrical flux compression experiments — for simulating zeta pinch flux rate in plasma cylinders
[UCRL-82142] N80-15939

PERSONAL AUTHOR INDEX

Typical Personal Author
Index Listing



Listings in this Index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

AARONSON, A. C. N80-15520
ABBEY, D. N80-15643
ABBOTTS, L. F. N80-15464
ABILOCK, H. N80-15634
ABOTTEEN, K. M. N80-15455
N80-15465
ABOTTEEN, R. A. N80-15507
N80-15508
N80-15509
ABUAF, N. N80-15385
ACTON, L. W. N80-16016
ADAMS, D. F. N80-15232
ADAMS, J. C. N80-15724
ADAMS, L. E. N80-15909
ADAMS, R. K. N80-15383
AGNEW, J. W. N80-15152
AHLERS, C. W. N80-15472
AHMAD, N. N80-15723
AHN, S. N80-15397
AHN, Y. K. N80-15576
AHTYE, W. F. N80-15129
AIELLO, R. N80-15077
ALBERTY, R. L. N80-15756
ALEXANDER, A. G. N80-15277
ALEXANDER, P. M. N80-15317
ALEXANDER, R. H. N80-15526
ALLEY, W. M. N80-15698
ALLSUP, J. R. N80-15280
ALLTOP, W. O. N80-15312
ALMOSNINO, D. N80-15032
ALPEROVITCH, Y. N80-15823
AMHERD, N. A. N80-15642
AMODEO, P. A., JR. N80-15785
ANANIA, G. L. N80-15306
ANDERSON, B. H. N80-15364
N80-15365
ANDERSON, C. A. N80-15718
ANDERSON, C. J. N80-15995
ANDERSON, D. F. N80-15382
ANDERSON, J. J. N80-15668
ANDERSON, P. J. N80-15278
ANDERSON, R. L. N80-15383
ANDERSON, T. W. N80-15550
ANDREWS, L. A. N80-15355
ANONSEN, W. H. N80-15461
ANSELL, G. S. N80-15076
ANTEPENKO, R. J. N80-15254
ANTHONY, R. G. N80-15297
ANTONOVA, G. A. N80-15781
ARAUJO, D. P. H. N80-15527
ARCHULETA, J. A. N80-15751
ARIAS, S. N80-15445
ARKO, A. J. N80-15960
ARMAN, A. N80-15723
ARNOLD, C., JR. N80-15273
ARNOLD, R. G. N80-15890
ARNOLD, R. T. N80-15760
ASHBURN, P. N80-15467
N80-15503
N80-15525
ASHURST, W. T. N80-15374
ASKAR, A. N80-15725
ATKINSON, S. E. N80-15287
AUGL, J. M. N80-15266
AULD, H. E. N80-15586
AYOUB, A. N80-15362

B

BADHWAR, G. N80-15472
BADNER, J. N80-15764
BAHR, D. W. N80-15121
BAILLIE, R. C. N80-15576
BAILY, P. N80-15399
BAKER, A. J. N80-15370
BAKER, J. R. N80-15514
BALDI, R. W. N80-15357
BALDWIN, R. G. N80-15580
BALLOU, L. B. N80-15899
BARAKAT, R. N80-15541
BARAN, R. N80-15662
BARASHOVA, Z. I. N80-15782
BARNES, A. A., JR. N80-15735
BARNES, C. S. N80-15153
BARNES, J. G. P. N80-15842
BARNES, R. H. N80-15684
BARNES, S. L. N80-15756
BARNETT, T. L. N80-15510
BARON, J. G. N80-15505
BARR, S. N80-15751
N80-15758
BARRETT, E. W. N80-15684
BARRETT, R. E. N80-15648
BARRON, W. F. N80-15699
BARTH, E. A. N80-15614
BARTHOLME, L. G. N80-15516
BASU, J. P. N80-15042
BATEMAN, H. N80-15931
BATHKE, C. G. N80-15677
BAUER, B. B. N80-15519
BAUER, M. E. N80-15321
BAUM, C. E. N80-15619
BAXTER, V. D. N80-15563
BAYLIN, F. N80-15087
BEACHER, B. F. N80-15207
BEAUPRE, G. S. N80-15275
BECKER, D. A. N80-15880
BECKER, R. L. N80-15426
BECKMAN, R. J. N80-15783
BEDARD, P. N80-15915
BEHAR, D. N80-15995
BEHRIN, E. N80-15999
BEIMBORN, E. N80-15442
BEISINGER, Z. E. N80-15822
BELETSKIY, V. V. N80-15323
BELLO, P. A. N80-15472
BENDER, M. J. N80-15077
BENDO, J. N80-15650
BENDURA, R. J. N80-15897
BENENATI, R. N80-15523
BENSON, J. L. N80-15883
BERGER, E. L. N80-15755
BERGER, M. I. N80-15951
BERGER, R. A. N80-15641
BERGERON, K. D. N80-15634
BERGSTROM, C. N80-15247
BERKOWITZ, J. N80-15527
BERNALDEZ, F. G. N80-15281
BERNARD, M. J., III N80-15554
BERNATOWICZ, D. T. N80-15707
BERNHARDT, P. A. N80-15360
BERRY, R. A. N80-15208
BERT, C. W. N80-15622
N80-15224
BERTRAM, L. K. N80-15226
N80-15724
BESEN, L. C. N80-15045
BETZ, A. N80-15281
BEVILAQUA, O. M. N80-15625
BIGELOW, H. R. N80-15218
BILL, R. G., JR. N80-15579
BIRD, R. N80-15048
BIRINGEN, S. H. N80-15331
BIRX, D. L. N80-15975
BITRAN, G. R. N80-15455
BIZZELL, R. M. N80-15465
N80-16017
BLAKE, J. B. N80-16019
BLAKE, R. L. N80-15604
BLANCHETT, R. S. N80-15835
BLANK, D. N80-15969
BLEDJIAN, L.
BLOMQUIST, C. A. N80-15629
BLUMENTHAL, O. N80-15036
BOARDMAN, C. N80-15323
BOATWRIGHT, G. O. N80-15510
BOATWRIGHT, S. M. N80-15469
BOBER, L. A. N80-15051
BOBICK, J. C. N80-15865
N80-15866
BODINE, J. H. N80-15446
BOES, E. C. N80-15578
BOGACIK, K. E. N80-15248
BOMELBURG, H. N80-15995
BOMKAMP, D. H. N80-15942
BOMKO, V. A. N80-15900
BONNER, J. N80-15547
BOOKER, B. L. P. N80-15250
BOOKER, M. K. N80-15250
BORGESON, N. S. N80-15276
BORLAND, R. G. N80-15818
BORMAN, E. A. N80-15779
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N80-15922
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BOUVIER, G. N80-15783
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BOWERS, J. N80-15915
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BRAND, S. N80-15733
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BRANDON, J. R. N80-15996
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BRASCHLER, C. B. N80-15450
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BRIGGS, J. L. N80-15257
BRIGGS, R. W. N80-15691
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BROOKS, R. D. N80-15913
BROOKS, W. P. N80-15627
BROUGH, W. G. N80-15899
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BRUMBERG, R. J. N80-15576
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BUCHAU, J. N80-15717
BUCKLEY, D. H. N80-15234
BUCKNAM, R. D. N80-15398

BUDER, T. E. N80-15541
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BUELOW, K. N80-15667
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BUNTSCHUH, C. N80-15335
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BURDGES, K. P. N80-15070
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BURK, S. D. N80-15710
BURKHOLDER, J. H. N80-15559
BURNS, W. A. N80-15373
BUROVSKIY, N. N. N80-15796
BURRUS, B. L. N80-15121
BURTON, R. L. N80-15926
BUSH, D. M. N80-15607
BUSHNELL, M. N80-15543
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BUSIK, J. R. N80-15692
BUTERA, M. E. N80-15535
BUTKOVICH, T. R. N80-15099
BUTLER, W. H. N80-15242
BYAR, T. R. N80-15073

C

CAIRNS, B. R. N80-15330
CAKMAK, A. S. N80-15725
CALVERT, S. N80-15672
CAMELIER, I. N80-15871
CANADA, D. C. N80-15226
CAPONIGRO, P. N80-15447
CARDER, B. M. N80-15408
CARLOS, R. C. N80-15751
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CARLSON, O. N. N80-15248
CARLSON, R. C. N80-15633
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CARPENTER, D. W. N80-15894
CARRIGAN, B. N80-15409
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N80-15850
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CASKEY, B. C. N80-15637
CASTLE, J. N80-15570
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CATO, C. J. N80-15309
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CAVANAGH, J. R. N80-15411
CEGLIO, N. M. N80-15401
CERMAK, J. E. N80-15733
CERNOCKY, E. P. N80-15431
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CHAI, A. T. C. N80-15556
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CHAPMAN, M. E. N80-15446
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CHATURVEDI, L. N80-15645
CHAUSSEE, D. S. N80-15049
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CHISUM, G. T. N80-15082
CHITTY, M. G. N80-15991
CHIU, W. S. N80-15263
CHOE, J. Y. N80-15397
CHRISTIE, W. H. N80-15226
CHU, G. C. N80-15328
CHU, Y. Y. N80-15823
CHUNG, Y. W. N80-15221
CICONE, R. N80-15534
CIERNA, V. N80-15778
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CINQUEMANI, V. N80-15580
CLANCY, R. M. N80-15748
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CLAYDON, J. C. N80-15499
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CLEMONS, A. N80-15102
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CLESCERI, N. L. N80-15411
CLINGMAN, D. L. N80-15627
CNARE, E. C. N80-15062
CNOSSEN, R. N80-15410
COE, H. H. N80-16020
COFFEY, H. E. N80-16021
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COHEN, J. B. N80-15944
COHEN, R. H. N80-15943
COLCHIN, R. J. N80-15714
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COLLINS, E. G. N80-15134
COLTRIN, R. E. N80-15311
COMPTON, R. T., JR. N80-15486
CONTE, D. N80-15616
CONWAY, T. M. N80-15681
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COOLEY, R. L. N80-15926
COOPER, A. L. N80-15829
CORTEVILLE, D. F. N80-15702
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COSMI, F. M. N80-15244
COSTELLO, P. K. N80-15627
COWAN, M. N80-15093
COWARD, W. E. N80-15962
COWLEY, J. M. N80-15960
CRABTREE, G. W. N80-15549
CRAIG, M. N80-15879
CRANDALL, D. H. N80-15589
CRANE, R. E. N80-15363
CRAWFORD, M. E. N80-15458
CREA, W. E. N80-15489
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CRISSMAN, B. W. N80-15603
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CRIST, E. N80-15823
CROOKS, W. H. N80-15411
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CROWLEY, J. D. N80-15561
CURTIS, H. B. N80-15395
CURTIS, R. A. N80-15414
CUSANO, C. N80-15813
CZEISLER, C. A.

D

DAGATI, A. D. N80-15713
DALLI, R. N80-16010
DANESI, A. N80-15171
DANG, V. N80-15897
DANIELS, E. J. N80-15278
DARIO, E. R. N80-15521
DAROSA, A. V. N80-15707
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DAUPHIN, V. M. N80-15470
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DAVIS, R. J. N80-15645
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DEARDORFF, D. D. N80-15984
DECELL, H. P., JR. N80-15496
DECKER, C. E. N80-15229
DEEDS, W. E. N80-15359
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DEFEO, A. N80-15106
DEITZ, P. H. N80-15917
DELUCIA, J. N80-15941
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DENYSZYN, R. B. N80-15674
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DESIMON, L. B. N80-15267
DESOPPER, A. N80-15168
DESTUYNDER, R. N80-15167
DEVAN, J. H. N80-15906
DEWAN, E. M. N80-15715
DEWEY, L. N80-15287
DICK, G. J. N80-15331
DICKENSON, R. L. N80-15276
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DICKMAN, P. T. N80-15909
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DINGLE, A. N. N80-15656
DISHAW, J. P. N80-15891
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DOE, T. N80-15911
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DOELLING, N. N80-15824
DOGGETT, J. N80-15670
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DOSCHEK, G. A. N80-16018
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DREIER, M. E. N80-15553
DRESSNER, L. N80-15351
DRIGGERS, W. G. N80-15522
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DUBOIS, D. F. N80-15940
DUCKETT, E. J. N80-15261
DUFF, W. S. N80-15616
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DUGGINS, D. C. N80-15383
DUNCAN, J. E. N80-15899
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DUPREY, B. B. N80-15476
DWOYER, D. L. N80-15371
N80-15372

E

EASON, J. W. N80-15210
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ECCLESTON, D. B. N80-15280
EDENBURN, M. W. N80-15578
EGGINS, P. L. N80-15391
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EHLERS, F. E. N80-15052
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EHSANI, M. N80-15350
EISGRUBER, L. M. N80-15450
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ELLIS, J. P. N80-15812
ELLIS, J. S. N80-15720
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ELLMAN, M. J. N80-15379
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ENDERS, J. H. N80-15060
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ERDOS, J. I. N80-15183
ERICKSON, J. D. N80-15491
ERMAK, D. L. N80-15626
ERNEST, R. K. N80-15270
ESCH, P. N80-15163
ESSOCK, D. M. N80-15137
ETCHECHURY, J. N80-15392
EVANS, R. S., II N80-15283
EVANS, S. M. N80-15469
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EVERETTE, J. M. N80-15470
EWALT, D. N80-15539
EWANIZKY, T. F. N80-15390
EYAL, Y. N80-15766

F

FALCOCCHIO, J. N80-16007
FALICOFF, W. N80-15628
FAM, A. T. N80-15139
FARAHAT, M. N80-15995
FARKAS, Z. D. N80-15353
FARLEY, R. D. N80-15769
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FEWELL, M. E. N80-15575
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FIELDS, R. A. N80-15068
FILLO, J. A. N80-15897
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FISK, Z. N80-15960
FLANDERS, D. C. N80-15401
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FLOWER, J. E. N80-15610
FLOWERS, F. L. N80-15480
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FRIGO, A. A. N80-15629
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N80-15922
FRYE, G. W. N80-15179
FUJA, R. E. N80-15350
FURLONG, D. B. N80-15553
FURMAN, E. R. N80-15560

G

GADDIS, J. L. N80-15688
GAGNON, W. L. N80-15358
N80-15938
GAKIS, J. D. N80-15066
GALANT, D. C. N80-15873
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GALLIKER, J. P. N80-15630
GANGI, A. F. N80-16014
GARCIA, M. N80-15277
GARRICK, I. E. N80-15046
GATTI, A. N80-15263
GAY, E. C. N80-15614
GEISLER, J. F. N80-15706
GEORGE, J. G. N80-15205
GERHARD, M. A. N80-15930
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GERSTENMAIER, W. N80-15364
GERWIN, R. A. N80-15934
GIERE, A. C. N80-15445
GIFFIN, R. G. N80-15087
GILBERT, G. N80-15062
GILBERT, W. P. N80-15160
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GILLESPIE, T. J. N80-15254
GILLMAN, H. D. N80-15199
GIRI, D. V. N80-15344
GLOVER, R. P. N80-15053
GLUECK, D. N80-15174
GODLEWSKI, M. P. N80-15555
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GOLDMAN, Y. N80-15214
GOLDSMITH, R. A. N80-15729
GOLDSTEIN, C. I. N80-15858
GOLDSTEIN, N. E. N80-15568
GOLUBKOV, V. V. N80-15822
GONZALEZ-MOLINA, C. N80-15277
GOOD, D. E. N80-15081
GOODBLOOD, G. E. N80-15142
GOODMAN, A. C. N80-15648
GOODMAN, L. R. N80-15546
GOODWIN, R. D. N80-15295
GOROCH, A. K. N80-15710
GOVINDARA, K. S. N80-15139
GRAFTON, S. B. N80-15160
GRAHAM, R. A. N80-15270
GRAHAM, R. S. N80-15830
GRAHAM, R. W. N80-15133
GRANDJEAN, N. R. N80-15575
GRANDON, R. A. N80-15238
GRAVES, R. L. N80-15620
GRIEBOWSKY, G. J. N80-15456
GREEK, D. C. N80-15073
GREELEY, R. N80-16010
GREEN, A. E. S. N80-15703
GREEN, M. A. N80-15373
GREENLAW, R. C. N80-15910
GREENWALD, A. N80-15340
GREENWOOD, J. R. N80-15849
GREGOR, P. J. N80-15481
GREGORY, D. C. N80-15879
GRENON, R. N80-15168
GRESHO, P. M. N80-15282
GRIESS, J. C. N80-15252
GRIFFITH, L. V. N80-15377
GRIFFITH, R. W. N80-15255
GRINER, G. M. N80-15197
GROSS, R. S. N80-15205
GROUNDS, D. J. N80-15795
GUCCIONE, L. N80-15423
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GUENTHER, G. C. N80-15548
GULDBERG, P. H. N80-15696
GUNN, T. L. N80-15595
GUPTA, Y. P. N80-15645
GURHAM, C. F. N80-16006
GUSEMAN, L. F., JR. N80-15496
GUSSENHOVEN, M. S. N80-15711
GUST, W. H. N80-15437
GUTSCHEWSKI, G. L. N80-15471

H

HAAK, R. N80-15236
HABERCOM, G. E., JR. N80-15671
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HACKETT, J. E. N80-15070
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N80-15072
HAGEMAN, K. C. N80-15984
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HAM, J. N80-15287
HAMERSMA, J. W. N80-15294
HAMILL, P. N80-15726
HAMILTON, R. H. N80-15276
HANCOCK, G. J. N80-15170
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HANKE, D. N80-15165
HANRAHAN, R. J. N80-15222
HANSEN, G. N80-15977
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HARDISON, D. L. N80-15519
HAREL, M. N80-15820
HARLAN, J. C. N80-15540
HARLOW, F. H. N80-15320
HARMUTH, H. F. N80-15403
HARRINGTON, R. F. N80-15517
HARRISON, W. E., JR. N80-15812
HARTLEY, H. O. N80-15819
HARTMAN, B. O. N80-15981
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HARTMANN, D. C. N80-15257
HATCH, R. E. N80-15998
HAUSBURG, D. E. N80-15768
HAVLICEK, S. C. N80-15460
HAWKINS, J. D. N80-15499
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HAY, R. D. N80-15197
HAZEL, L. H. N80-15994
HECHLER, K. N80-15657
HECK, W. W. N80-15800
HECKART, S. A. N80-15964
HEHS, W. N80-15876
HEIDELBERG, L. J. N80-15919
HEISERMAN, J. N80-15842
HELLIARD, J. C. N80-15648
HENDERSON, R. W. N80-15933
HENNING, C. D. N80-15701
HENRY, W. M. N80-15830
HENSON, C. C. N80-15557
HERMANN, A. M. N80-15207
HERMANN, G. N80-15722
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HESS, J. L. N80-15750
HEWSON, E. W. N80-15455
HEYDORN, R. P. N80-15491
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HIBBS, S. N80-15485
HICKMAN, J. R. N80-15522
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HILBRAND, R. R. N80-15371
HILL, J. A. N80-15372
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HINDMAN, E. E., II N80-15249
HIRASAKA, M. N80-15769
HIRSCH, J. H. N80-15255
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HITCHCOCK, R. R. N80-15979
HITZ, K. L. N80-15955
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HOBBS, P. V. N80-15722
HODGESON, J. A. N80-15691
HOFFMAN, D. C. N80-15930
HOFFMAN, M. A. N80-15059
HOLDEMAN, J. D. N80-15803
HOLLAND, F. F., JR. N80-15534
HOLMES, Q. N80-15793
HOMICK, J. L. N80-15143
HOOPER, E. H. N80-15676
HOPKINS, H. T. N80-15845
HOPP, T. H. N80-15461
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HORRIGAN, D. J. N80-15156
HORSTMANN, K. H.
HORVAY, G. N80-15443
HOULIHAN, S. C. N80-15371
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HOUSTON, A. G. N80-15449
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HOWES, W. L. N80-15538
HOWLAND, M. M. N80-15358
HOWLETT, J. T. N80-15876
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HSIE, E. Y. N80-15769
HSIEH, E. J. N80-15213
HSU, E. M. N80-15472
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N80-15488
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HUANG, T. V. N80-15831
HUBERT, L. F. N80-15759
HUDLOW, M. D. N80-15765
HUDSON, C. L. N80-15995
HUEY, H. E. N80-15935
HUFFAKER, R. M. N80-15757
HUFFMAN, D. R. N80-15918
HUGET, E. F. N80-15267
HUGGINS, A. W. N80-15767
HUGHES, R. L. N80-15607
HUIE, R. E. N80-15722
HULL, W. N80-15298
HULLER, F. T. N80-15420
HULSTROM, R. N80-15570
HUNDEMANN, A. S. N80-15542
N80-15721
HUNTER, H. F. N80-15142
HUPPI, R. J. N80-15661
HURD, A. G. N80-15398
HURD, H. A. N80-15275
HURST, R. L. N80-15524
HYDER, S. B. N80-15330
HYMAN, M. C. N80-15371
N80-15372

I

ICHBIAH, J. D. N80-15842
INGOLS, R. S. N80-15998
IRETON, V. N80-15304
IRVINE, J. N80-15315
ISAACS, H. N80-15897
ISLER, R. C. N80-15887
IVY, J. T. N80-15697

J

JACKIW, R. N80-15971
JACKSON, R. D. N80-15533
JACKSON, R. J. N80-15257
JADWICK, J. J. N80-16009
JANKE, D. H. N80-15909
JARDIN, S. C. N80-15941
JASPERSON, W. H. N80-15763
JASSBY, D. L. N80-15907
JEANLOZ, R. N80-15532
JEFFRESS, C. H. N80-15470
JEFFRIES, H. E. N80-15696
JEFFRIES, K. D. N80-15204
JENKINS, D. J. N80-15926
JENNINGS, M. E. N80-15677
JENNISON, D. R. N80-15956
JIUSTO, J. E. N80-15747
JOHANNES, R. P. N80-15159
JOHANSON, R. C. N80-15551
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JOHNSON, C. L. N80-15477
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JOHNSON, L. C. N80-15810
N80-15814
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JOHNSON, W. C. N80-15342
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JONES, C. D. N80-15604
JONES, G. J. N80-15566
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JONES, J. H. N80-15838
JONES, O. C., JR. N80-15385
JONES, R. T. N80-15033
JOSHI, S. M. N80-15201
JUDAY, R. D. N80-15506
N80-15507
JUDD, O. P. N80-15892
JULIAN, P. R. N80-15766
JUNGE, D. C. N80-15293

JUST, R. A. N80-15581

K

KACZYNSKI, R. F. N80-15194
KABILE, A. B. N80-15529
KABILE, H. N80-15446
KALLIAPUR, V. N80-15240
KAMPAS, F. J. N80-15255
KANNEL, J. W. N80-15412
KANTOR, A. J. N80-15714
KAPER, H. G. N80-15860
KAPLAN, H. L. N80-15790
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KARAMCHETI, K. N80-15362
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KARDOS, J. L. N80-15209
KASCAK, A. F. N80-15128
KATZ, J. J. N80-15784
KAUFMAN, A. N. N80-15921
KAUFMAN, J. N80-15545
KAUTH, R. J. N80-15497
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N80-15534
KAYS, W. M. N80-15363
KEATING, R. F. A. N80-15153
KEMBER, W. T. N80-15154
KERS, R. A. N80-15341
KELLER, E. N80-15552
KELLY, J. T. N80-15687
KENNEDY, D. P. N80-15954
KESKINEN, M. J. N80-15716
KESSLER, H. K. N80-15646
KEY, S. W. N80-15442
KEYES, C. G., JR. N80-15645
KHIZNYAK, N. A. N80-15900
KHURI-YAKUB, B. N80-15915
KIESSLING, F. N80-15144
KILGORE, W. C. N80-15594
KIMBALL, O. F. N80-15251
KINDALL, S. M. N80-15836
KING, W. J. N80-15603
KINO, G. S. N80-15915
KINSLOW, M. N80-15660
KLEFFE, J. N80-15867
KLEIN, E. N80-15803
KLEIN, K. E. N80-15808
N80-15816
KLEMETTI, W. I. N80-15318
KLINGSPORN, P. E. N80-15957
KLUCHER, T. M. N80-15555
KOCAY, C. A. N80-15622
KOCH, V. R. N80-15569
KOEGLER, J. A., JR. N80-15050
KOENIG, R. F. N80-15258
KOERNER, H. N80-15150
KOFFYBERG, F. P. N80-15949
KOGER, T. N80-15682
KOGUT, J. B. N80-15968
KOHN, S. D. N80-15305
KOIDE, G. N80-15628
KOPP, F. J. N80-15769
KORSAKOV, I. A. N80-15780
KOSAKI, M. N80-15346
KOUTS, H. N80-15897
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KRAFT, M. L. N80-15294
KRAISS, F. N80-15973
KRAKOWSKI, R. A. N80-15931
KRAMER, S. N80-16004
KRATZER, R. H. N80-15545
KRAZINSKI, J. L. N80-15376
KREFT, A. E. N80-15380
KREMPL, E. N80-15240
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KRIEG-BRUECKNER, B. N80-15842
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KROTOV, V. P. N80-15798
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KRUPTA, M. C. N80-15565
KUESTER, J. L. N80-15291
KUIPERS, J. W. N80-15989
KUJAWSKI, D. N80-15240
KULINA, M. N80-15106
KULLMAN, R. C. N80-15995
KUSAK, L. N80-15202
KUSCHNER, M. N80-15897
KUSTOM, R. L. N80-15350
KWAN, T. J. N80-15400
KWIATKOWSKI, J. W. N80-15719

L

LABRANDERO, D. J. L. N80-15527
LABRY, J. N80-15751
LAI, G. Y. N80-15251
LAKE, L. M. N80-16002
LALLI, V. R. N80-15422
LAMBECK, P. F. N80-15497
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LAMOSOVA, D. N80-15778
LANDAU, L. N80-15226
LANDINGHAM, G. M. N80-15983
LANDRAM, C. S. N80-15375
LANKFORD, J. N80-15435
LANSINGER, J. M. N80-15680
LAQUE, F. L. N80-15573
LAROCHELLE, L. N80-15783
LARSEN, W. E. N80-15821
LASAGNA, P. L. N80-15028
LAUB, A. J. N80-15853
LAW, D. A. N80-15306
LAWRENCE, T. R. N80-15757
LAZARETH, O. N80-15897
LAZARUS, D. N80-15860
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LEAVITT, R. P. N80-15457
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LEE, A. H. N80-15300
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LEEMANN, C. N80-15648
LEFFEL, C. S., JR. N80-15948
LEHOCZY, S. L. N80-15553
LEIBLEIN, S. N80-15852
LEISERSON, C. E. N80-15495
LENNINGTON, R. K. N80-15766
LEVANON, N. N80-15393
LEVENTHAL, J. J. N80-15872
LEVINE, H. N80-15647
LEVY, A. N80-15684
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LEWANDOWSKI, A. N80-15371
LEWIS, C. H. N80-15372
N80-15197
LEWIS, C. L. N80-15302
LEWIS, D. N80-15551
LEYTHAM, K. M. N80-15920
LIM, J. S. N80-15587
LIN, E. I. H. N80-15434
LIN, G. F. N80-16008
LINSKY, J. L. N80-15452
LISZCZ, C. J. N80-15469
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LITTLE, J. N80-15562
LITTLE, S. A. N80-15331
LITTLE, W. A. N80-15344
LIU, T. K. N80-15709
LLOYD, J. N80-15616
LOEF, G. O. G. N80-15076
LOEWY, R. G. N80-15553
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LONG, P. L. N80-15348
LONG, W. F. N80-15527
LOPEZDESAGREDO, F. N80-15172
LORINCZ, D. J. N80-15589
LORSCH, H. G. N80-15733
LOU, J. J. N80-15399
LOVEJOY, C. N80-15757
LOVELAND, R. N80-15486
LOVFALD, L. O. N80-15720
LOVILL, J. E. N80-15747
LOW, R. D. H. N80-15235
LOWELL, C. E. N80-15549
LUEBBE, R. N80-15935
LUHMANN, N. C., JR. N80-15998
LUPTON, J. D. N80-15072
LYMAN, V. N80-15479
LYON, J. C. N80-15887
LYON, J. F. N80-15528
LYON, R. J. P.

M

MA, A. N80-15851
MABEY, D. G. N80-15169
MACKALL, K. G. N80-15028
MACKIN, T. F. N80-15466
MACMILLER, C. J. N80-15073
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MAKAROV, G. A. N80-15799
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MANHARDT, P. D. N80-15370
MANHEIMER-TIMNAT, Y. N80-15214
MANTEUFFEL, T. A. N80-15861
MANZANO-RUIZ, J. N80-15415
MARAMAN, W. J. N80-15902
MARESCA, T. J. N80-15380
MARONDE, R. G. N80-15307
MARQUIS, D. L. N80-15484
MARSH, S. E. N80-15529
MARSHALL, W. F. N80-15667
MARTIN, J. A. N80-15776
MARTIN, T. H. N80-15908
MARTINO, F. J. N80-15614
MARTZ, H. F., JR. N80-15426
MASAKI, M. N80-15056
MASZ, E. N80-15935
MATSON, R. N80-15767
MAUL, G. A. N80-15543
MAURO, P. G. N80-15066
MAXWELL, W. A. N80-15252
MAY, G. A. N80-15467
N80-15525
MAY, P. W. N80-15775
MAYR, M. C. N80-15699
MAZANDARANY, F. N. N80-15258
MAZARIS, G. A. N80-15555
MCALLUM, W. E. N80-15469
MCBRIDE, M. F. N80-15604
MCCALL, D. L. N80-15065
MCCLATCHEY, R. A. N80-15713
MCCLELLAND, D. R. N80-15523
MCCRARY, D. G. N80-15468
MCCREIGHT, L. R. N80-15263
MCCULLEY, G. N80-15129
MCDEVITT, P. K. N80-15562
MCDONALD, S. W. N80-15921
MCEWEN, M. C. N80-15519
MCFALLS, R. A. N80-15083
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MCGRATH, S. V. N80-15444
MCHENRY, R. L. N80-15185
MCINTOSH, B. A. N80-15830
MCKENZIE, R. C. N80-15530
MCKIBBEN, R. N80-15682
MCKINLEY, T. N80-15670
MCLAUGHLIN, A. J. N80-15950
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MCOWAT, D. M. N80-15169
MCWHORTER, A. L. N80-15950
MEHTA, A. J. N80-15296
MEI, C. N80-15432
MEIER, G. H. N80-15233
MELESHKOVA, Y. N80-15900
MELIA, M. N80-15682
MELLO, J. F. N80-15152
MENENDEZ, M. A. N80-15246
MENIKOFF, R. N80-15857
MERCEREAU, J. E. N80-15331
MEREDITH, D. B. N80-15616
MERRITT, B. T. N80-15408
MESHIL, M. N80-15245
MESICH, F. G. N80-15689
METZGER, D. E. N80-15360
MEURZEC, J. L. N80-15145
MEYER, C. N80-15537
MEYER, S. F. N80-15213
MIAO, C. C. N80-15376
MICHAEL, C. N80-15176
MICHAL, C. N80-15302
MICHALSKI, S. R. N80-15691
MICKEY, F. T. N80-15830
MIDDLEBROOKS, E. J. N80-15786
MIFSUD, L. N80-15177
MIKHNEVICH, V. V. N80-15704
MILLER, A. C., JR. N80-15403
MILLER, A. K. N80-15416
MILLER, D. A. N80-15680
MILLER, H. C. N80-15961
MILLER, J. E. N80-15677
MILLER, R. L. N80-15931
N80-15932
MILLER, S. A. N80-15339
MILLNER, A. R. N80-15609
N80-15635
MINGLE, J. G. N80-15293
MINTER, T. C. N80-15500
MIRALLES, D. J. M. N80-15527
MISEL, O. W. N80-15103
MISKEVICS, A. J. N80-15436
MISRA, P. N. N80-15502
MITA, K. N80-15889
MITCHELL, J. R. N80-15846
MITCHELL, S. C. N80-15110
MIYOSHI, K. N80-15234
MOFFA, P. J. N80-15367
MOFFAT, R. J. N80-15363
MOLLOY, K. C. N80-15955
MONES, E. T. N80-15212
N80-15272
MONTALVO, F. S. N80-15802
MONTAN, D. N. N80-15899
MONTGOMERY, W. D., III N80-15592
MOONEY, P. M. N80-15352
MOORE, J. G. N80-15717
MOORE, W. A. N80-15172
MOOREEDE, M. C. N80-15813
MORAN, T. J. N80-15997
MORETTO, L. G. N80-15904
MORFIN, H. W. N80-15186
N80-15187
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MORGAN, R. J. N80-15272
MORITZ, T. E. N80-15494
MORJARIA, M. N80-15438
N80-15864
MOROZUMI, F. N80-15249
MORRIS, R. E. N80-15074
N80-15075
MORSE, J. G. N80-15284
MORWAY, P. E. N80-15082
MOULDEN, T. H. N80-15057

MOYNES, J. F. N80-15158
MUKHERJEE, S. N80-15438
N80-15864
MULCAHY, T. M. N80-15436
MUNK, M. M. N80-15038
N80-15039
N80-15040
N80-15041
MURPHY, D. P. N80-15232
MURRAY, R. C. N80-15303
MUSCIANESI, P. N80-15315
MUSGRAVE, C. N80-15313
MYNICK, H. E. N80-15929

N

NACHTWEY, D. S. N80-15794
NAGAMIYA, S. N80-15888
NAKAHARA, J. H. N80-15545
NALEZNY, C. L. N80-15384
NANNELLI, P. N80-15199
NARAYAN, J. N80-15352
NASBY, R. D. N80-15577
NASTROM, G. D. N80-15059
NAU, R. F. N80-15719
NAWAB, H. N80-15920
NEALY, S. M. N80-15903
NEFF, M. A. N80-15300
NEIERS, J. W. N80-15825
NELSON, E. T. N80-15576
NELSON, P. N80-15911
NELSON, P. A. N80-15611
NELSON, R. M. N80-15464
NELSON, T. A. N80-15303
NELSON, W. E., JR. N80-15158
NEMAT-NASSER, S. N80-15206
NEPPERT, H. N80-15178
NESTOR, C. W., JR. N80-15359
NEUBAUER, P. N80-15687
NEUDER, S. M. N80-15804
NEUMANN, H. E. N80-15134
NEWBERGER, B. S. N80-15905
N80-15945
NEWEY, H. A. N80-15212
NEWKIRK, L. R. N80-15211
NEWMAN, E. H. N80-15310
NEWMAN, F. M. N80-15265
NEWMAN, J. C., JR. N80-15430
NGUYEN, L. T. N80-15160
NGUYEN, N. Q. N80-15209
NIBLETT, L. T. N80-15147
NICHOLSON, A. N. N80-15818
NIEDBAL, N. N80-15146
NIELSEN, J. N. N80-15171
NIGHAN, W. L. N80-15394
NORTON, J. M. N80-15984
NUNEZDELASCUEVAS, R. N80-15527
NUNNALLY, N. R. N80-15552
NVOTA, J. N80-15778

O

OBERSCHMIDT, J. M. N80-15349
OBRIEN, C. J. N80-15203
OCONNELL, J. S. N80-15828
OCONNELL, L. G. N80-15995
ODELL, E. L. G. N80-15380
ODONNELL, W. J. N80-15441
OESTERWINTER, C. N80-15192
OEY, K. T. N80-15301
OHMSTEDE, W. D. N80-15740
OITTO, R. H. N80-15544
OLAISEN, H. N80-15915
OLIVER, A. N80-15783
OLIVER, R. M. N80-15719
OLMERT, M. N80-16004
OLSZEWSKI, M. N80-15625
ONAT, E. N80-15135
ORANGE, T. W. N80-15428
ORHAM, E. L. N80-15407
ORTEZ-VELEZ, J. N80-15277
ORVILLE, H. D. N80-15769
OSTERHOUDT, F. H. N80-15490
OSTGAARD, M. A. N80-15140
OTTE, E. N80-15306
OUZTS, S. O. N80-15730
OWEN, F. K. N80-15164
OWEN, M. L. N80-15689
OWICKI, S. S. N80-15839
OZGA, M. N80-15549

P

PACIOREK, K. L. N80-15545
PACKARD, R. L. N80-15520
N80-15522
PACKER, M. E. N80-15421
PADDOCK, R. A. N80-15664
PAFF, A. J. N80-15271
PAGLIARULO, R. P. N80-15318
PAINTER, L. R. N80-15217
PALEY, H. N. N80-15529
PALMER, W. F. N80-15505
PANCOAST, F. O. N80-15380
PANOFSKY, H. A. N80-15710
PARKER, D. M. N80-15258
PARKER, J. C. N80-15686
PARKER, R. N80-15672
PARMENTOLA, J. N80-15682
PARRILLA, D. A. N80-15527
PARRIS, B. L. N80-15069
PARRISH, J. L. N80-15771
PARSONS, C. L. N80-15727
PARUNGO, F. P. N80-15758
PATANKAR, S. V. N80-15376
PATRICK, W. C. N80-15899
PATTERSON, G. K. N80-15219
PATTERSON, R. N80-15672
PATTERSON, R. L. N80-15462
PAULES, G. E. N80-16000
PAULIKAS, G. A. N80-16017
PAULSEN, G. M. N80-15511
PAULSSON, B. N80-15911
PAYNE, B. W. N80-15148
PAYNE, R. W. N80-15505
PEAKE, D. J. N80-15164
PEARMAIN, A. J. N80-15346
PEARSON, C. N80-15777
PEARSON, M. J. N80-15685
PEARTREE, R. J. N80-15591
PEGG, R. J. N80-15875
PELLIZZARI, F. N80-15674
PENTLAND, A. P. N80-15497
PERINELLE, J. N80-15177
PERKINS, P. J. N80-15059
PERLADO, D. J. P. N80-15527
PERRINE, R. L. N80-16002
PESUT, R. N. N80-15701
PETERS, R. R. N80-15574
PETERSON, B. N80-15433
PETERSON, J. M. N80-15386
PETRY, F. E. N80-15843
PETTIBONE, J. A. N80-15566
PFANN, H. N80-15992
PHANEUF, R. A. N80-15879
PHANG, W. A. N80-15305
PHELPS, P. L. N80-15626
PHILPOTTS, J. A. N80-16015
PHINNEY, D. E. N80-15458
N80-15488
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N80-15514
PIAZZOLI, G. N80-15145
PICKERING, L. N80-15323
PICKLES, W. L. N80-15928
PICON, D. J. L. N80-15527
PIENAAR, A. J. N80-15329
PIERSON, W. J. N80-15732
PIETZ, P. N80-15302
PIJANOWSKI, B. S. N80-15386
PINTO, R. N80-15323
PISTER, K. S. N80-15719
PITCHFORD, M. N80-15685
PITRUZZELLO, M. C. N80-15846
PITTS, D. E. N80-15472
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PLEIN, H. G. N80-15253
POIRIER, L. J. N80-15783
POLITOVICH, M. K. N80-15770
POLLACK, J. B. N80-15726
PONT, W. N80-15534
POOLE, E. W. N80-15480
POPLIN, J. K. N80-15723
POPPOFF, I. G. N80-15726
PORE, M. D. N80-15494
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POROWSKI, J. S. N80-15441
PORTER, G. A. N80-15840
PORTER, J. J. N80-15688
POTTER, A. E. N80-15649
POTTER, J. F. N80-15487
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POVINELLI, L. A. N80-15134
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POWELL, J. D. N80-15316
POWELL, J. R. N80-15227
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POYTHRESS, M. H. N80-15998
POZAR, D. M. N80-15310
PRANDTL, L. N80-15034
PRATT, F. J. N80-15757
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PRATT, R. H. N80-15886
PRELAT, A. E. N80-15528
PRESSER, C. N80-15214
PRICE, D. F. N80-15928
PRICE, K. M. N80-15707
PROCTOR, M. H. N80-15450
PROKHOROV, V. Y. N80-15779
PROSSER, R. J. N80-15391
PROULX, H. N80-15758
PUESCHEL, R. F. N80-15758
PURNELL, R. F. N80-15523
PURVIS, C. K. N80-15200
PUTNAM, T. W. N80-15028
PYTLOWANY, P. J. N80-15765

Q

QUATE, C. F. N80-15919
QUIGG, C. N80-15970
QUINLAN, J. R. N80-15987
QUIREIN, J. A. N80-15455

R

RAAL, J. D. N80-15230
RACCAH, P. M. N80-15953
RACETTE, G. W. N80-15380
RADER, M. L. N80-15472
N80-15474
RADFORD, L. M. N80-15903
RADKE, L. F. N80-15770
RAMSEY, J. W. N80-15584
RAMSPOTT, L. D. N80-15899
RANDLE, R. J., JR. N80-15821
RANGHELLI, J. N80-15315
RAO, C. R. N80-15582
N80-15867
RAO, C. R. N. N80-15750
RASMUSSEN, J. E. N80-15318
RASSBACH, M. E. N80-15495
RATHBUN, R. E. N80-15690
RATZEL, A. C. N80-15585
RAVENHALL, R. N80-15108
RAVET, F. W. N80-15520
READ, D. T. N80-15258
READING, J. F. N80-15880
REARDON, L. F. N80-15068
REDDEN, M. R. N80-16005
REDDINGTON, R. L. N80-15268
REDDY, K. C. N80-15057
REED, J. W. N80-15878
REED, W. E. N80-15260
N80-15325
N80-15327
N80-15418
REEDY, E. D., JR. N80-15624
REGISTER, D. T. N80-15496
REHBEIN, D. K. N80-15248
REICH, S. N80-15863
REIDINGER, F. N80-15955
REIFF, P. H. N80-15712
REINBERG, A. N80-15807
N80-15815
REYNOLDS, J. H. N80-15786
RIBARSKY, M. W. N80-15241
RICE, E. J. N80-15876
RICHARDS, F. P. N80-15765
RICHARDSON, L. D. N80-15828
RICHARDSON, W. N80-15497
N80-15501
RIEDEL, J. T. N80-15753
RIEPE, K. B. N80-15345
RILEY, R. E. N80-15211
RINDE, J. A. N80-15212
N80-15632
RIX, O. N80-15165
RIZZO, F. J. N80-15136
ROBBEN, F. N80-15218
ROBERTS, A. S., JR. N80-15201
ROBINSON, D. N. N80-15440
RODEKOHR, M. N80-15631
RODRIGUEZ, R. N80-15731
ROGERS, J. L. N80-15468
ROM, J. N80-15032
ROSE, B. A. N80-16006
ROSE, H. A. N80-15940
ROSE, L. R. F. N80-15429
ROSEN, A. N80-15427
ROSENBAUM, D. N80-15361
ROSENDAL, H. E. N80-15754
ROSENZWEIG, J. J. N80-15675
ROSINI, E. N80-15447
ROSNER, D. E. N80-15130
N80-15131
ROSNER, J. L. N80-15970
ROSS, A. J. N80-15151
ROSS, J. N80-15223
ROSSO, M. J., JR. N80-15286
ROTSZTEIN, Y. N80-15834
ROUBINE, O. N80-15842
ROZANOVA, V. D. N80-15781
ROZSA, R. B. N80-15219
RUBACH, H. N80-15035
RUBLOFF, G. W. N80-15216
RUDOLPH, H. N80-15659
RUNKLE, S. N. N80-15306
RUTECKI, D. J. N80-15380
RYAN, L. E. N80-15264
RYNASKI, E. G. N80-15139
RYNES, P. E. N80-15848

S

SABLA, P. E. N80-15121
SACCO, S. R. N80-15638
SAHLIN, H. L. N80-15928
SAKAMOTO, C. M. N80-15457

SALEMME, C. T. N80-15098
SAMMELLS, A. F. N80-15613
SAMPATH, V. N80-15613
SANAIE-FARD, M. N80-15338
SANDERSON, R. N80-15178
SANTELLI, R. M. N80-15972
SARDINAS, V. N80-15064
SAWYER, D. E. N80-15644
N80-15646
SAXTON, M. J. N80-15684
SCALAPINO, D. J. N80-15331
SCARGLE, J. D. N80-15054
SCARLETT, W. R. N80-15345
SCHAETZLE, W. J. N80-15588
SCHAFFT, H. A. N80-15644
N80-15646
SCHECHTER, B. N80-15411
SCHEFER, R. N80-15218
SCHENK, G. R. N80-15606
SCHLEMPER, L. J. N80-15644
SCHMITT, R. C. N80-15376
SCHMITT, V. N80-15175
SCHNAPER, G. H. N80-15569
SCHOOLEY, F. A. N80-15276
SCHOWEBEL, R. L. N80-15220
SCHUELER, D. G. N80-15578
SCHUHMANN, R., JR. N80-15296
SCHULZ, D. F. N80-15999
SCHUMMERS, J. H. N80-15661
SCOLATTI, C. A. N80-15162
SCULLY, W. C. N80-15668
SEAY, J. G. N80-15270
SECREST, B. G. N80-15309
SEELEY, M. W. N80-15514
SEGEV, A. N80-15285
SELF, H. C. N80-15600
SELMAN, J. R. N80-15613
SEPSY, C. N80-15604
SETHURAMAN, S. N80-15773
SGRO, A. N80-15937
SHA, W. T. N80-15376
N80-15587
SHAFER, R. D. N80-15578
SHAH, V. L. N80-15376
SHAHIN, M. Y. N80-15305
SHAKET, E. N80-15823
SHAMES, V. A. N80-15837
SHAVERS, D. C. N80-15401
SHAW, R. J. N80-15237
SHAW, R. W. N80-15404
SHEA, D. N80-15766
SHEEHAN, W. H. N80-15398
SHEINBERG, H. N80-15211
SHELPUK, B. N80-15571
SHEPHERD, O. N80-15398
SHERMAN, S. W. N80-15186
N80-15187
N80-15188
N80-15189
N80-15190
N80-15191
SHIELDS, K. J. N80-15676
SHILOV, V. M. N80-15779
SHIMOTAKE, H. N80-15614
SHINAR, J. N80-15834
N80-15835
SHIPPY, D. J. N80-15136
SHLADOVER, S. E. N80-16000
SHOFNER, F. M. N80-15403
SHORE, R. W. N80-15681
SHOWALTER, T. W. N80-15069
SIBLEY, E. H. N80-15827
SICKLES, J. E., II N80-15673
SIDDALINGAPPA, S. R. N80-15170
SIDDIQEE, W. N80-16000
SIDES, J. N80-15168
SIDIK, S. M. N80-15235
SIEGEL, W. H. N80-15068
SIGMAN, R. N80-15549
SIMANEK, E. N80-15354
SIMMONS, A. C. N80-15391
SIMONOV, A. I. N80-15603
SIMPSON, W. A., JR. N80-15877
SINGH, P. N80-15783
SIVER, P. A. N80-15694
SIVJEE, G. G. N80-16012
SKAGGS, G. N80-15709
SKOV, A. M. N80-15172
SLAUGHTER, G. M. N80-15425
SMART, D. N80-15343
SMART, R. T. N80-15502
SMIDDY, M. N80-15712
SMIRL, A. L. N80-15952
SMITH, C. A. N80-15173
SMITH, C. F., JR. N80-15562
SMITH, D. H. N80-15224
N80-15226
SMITH, H. I. N80-15401
SMITH, M. N80-15682
SMITH, T. N80-15236
SMITH, W. H. N80-16011
SMOLKA, S. N80-15171
SNELLING, R. N80-15685
SNOEBERGER, D. F. N80-15668
SODEN, J. M. N80-15965
SOLBRIG, C. W. N80-15384
SOLLFREY, W. N80-15322
SOMMER, H. J., III N80-15414
SONNLEITNER, W. N80-15166
SOO, S. L. N80-15587
SORVARI, J. M. N80-15196
SOUERS, P. C. N80-15292
SOWERS, H. D. N80-15093
SPAR, J. N80-15728
SPARKS, L. E. N80-15686
SPARROW, E. M. N80-15584
SPEARS, R. K. N80-15269
SPENCER, R. L. N80-15963
SPIERS, B. E. N80-15462
SPITZER, J. F. N80-15481
SPITZER, R. H. N80-15296
SPRINGETT, J. C. N80-15307
STAFFELDT, E. E. N80-15298
STANLEY, W. I. N80-15480
STAVENOHA, L. L. N80-15265
STEIN, G. N80-15853
STEINBERG, B. N80-15243
STEINBERG, M. N80-15897
STELTZ, W. G. N80-15417
STEPANOVA, T. A. N80-15822
STERNBERG, S. N80-15972
STEUNENBERG, R. K. N80-15611
STEWART, L. N80-15958
STEVERT, W. A. N80-15289
STIFFLER, J. J. N80-15423
N80-15424
STIGLITZ, M. R. N80-15332
STIMPERT, D. L. N80-15083
N80-15084
N80-15085
N80-15102
N80-15118
STOHLER, S. L. N80-15179
STONE, B. M. N80-15818
STONE, R. G. N80-15612
STOTLER, C. L., JR. N80-15094
N80-15100
N80-15407
N80-15029
N80-15215
N80-15995
N80-15576
N80-15949
STOWERS, I. F. N80-15600
STRACK, S. L. N80-15457
STRAHLE, W. C. N80-16016
STRICKLAND, G. N80-15256
STRINGER, R. P. N80-15488
STROBEL, P. N80-15489
STROMBERG, R. P. N80-15510
STROMMEN, N. D. N80-15514
STRONG, R. T. N80-15366
STUDT, P. L. N80-15570
STUFF, R. G. N80-15716
N80-15466
N80-15967
N80-15455
N80-15953
N80-15766
N80-15654
N80-15939
N80-15225
N80-15844
N80-15645
N80-15557
N80-15558
N80-15405
N80-15546
N80-16011
STURTEVANT, B. N80-15186
SU, W. N80-15187
SUDAN, R. N. N80-15188
SULESTER, J. M. N80-15189
SUMMERS, G. P. N80-15190
SUMNER, C. A. N80-15191
SUNDARAM, S. N80-15676
SUOMI, V. E. N80-15779
SUSKO, M. N80-15614
SUTER, L. J. N80-15834
SUTHERLAND, J. C. N80-15835
SUTTON, S. A. N80-15136
SWANBERG, C. A. N80-16000
SWARTZ, C. K. N80-15403
N80-15681
SWEATT, W. C. N80-15069
SWIFT, R. N. N80-15827
SZE, N. D. N80-15673
N80-15170
N80-16000
N80-15168
N80-15235

T

TAFF, L. G. N80-15068
TAKAHASHI, P. N80-15549
TAKEUCHI, D. I. N80-15354
TAKEUCHI, D. M. N80-15391
TALBOT, L. N80-15603
TALWANI, M. N80-15877
TAM, S. W. N80-15783
TAMBERRINO, S. N80-15694
TANGLER, J. L. N80-16012
TARAKANOVA, O. I. N80-15709
TARBET, J. D. N80-15172
TAYLOR, J. D. N80-15425
TAYLOR, W. C. N80-15343
TEMPLE, R. F. N80-15502
TESAROVA, D. N80-15712
TESCHE, F. M. N80-15952
THEODORSEN, T. N80-15173
N80-15562
THODE, L. E. N80-15224
THOMAS, D. L. N80-15226
THOMAS, G. S. N80-15401
THOMAS, H. H. B. M. N80-15682
THOMAS, M. G. N80-15236
THOMAS, R. A. N80-16011
THOMAS, R. W. N80-15171
THOMAS, R. W. L. N80-15685
THOMASELL, A., JR. N80-15668
THOMASON, J. N80-15965
THOMPSON, C. N80-15384
THOMPSON, D. R. N80-15482
N80-15483
THOMPSON, P. M. N80-15853
THOMPSON, R. C. N80-15916
N80-15922
THORPE, R. N80-15911
THORPE, R. W. N80-15989
TIPPIE, J. W. N80-15848
TODD, A. M. M. N80-15941
TOLLE, F. F. N80-15135
TOMMERDAHL, J. B. N80-15229
TONKIN, T. G. N80-15388
TOON, O. B. N80-15726
TOTH, W. J. N80-15648
TOWNE, C. E. N80-15365
TOWSE, D. N80-15894
N80-15896
TRAEGER, R. K. N80-15284
TRAINOR, F. R. N80-15694
TRAVIS, C. C. N80-15862
TREADO, S. J. N80-15387
TREFFTZ, E. N80-15037
TRENCHARD, M. H. N80-15488
N80-15512
N80-15514
TRICHEL, M. C. N80-15491
TROGLER, W. C. N80-15247
TSANG, C. F. N80-15618
TSE-WEN, H. N80-15925
TURCHI, P. J. N80-15926
TURCO, R. P. N80-15726
TUREKIAN, K. K. N80-15683
TURNHAM, T. N80-15803
TURTLE, J. P. N80-15318

U

UHLMANN, D. R. N80-16013
UHLEIN, J. N80-15682
UMBERGER, D. E. N80-15450
N80-15457

V

VALENCIA, F. A. N80-15211
VALKILI-DASTJERDI, A. N80-15057
VANDERHUCHT, K. A. N80-16008
VANIER, P. E. N80-15255
VANKA, S. P. N80-15376
VANSTON, J. H. N80-15642
VARADAN, V. K. N80-15433
VARADAN, V. V. N80-15433
VARLEY, D. J. N80-15735
VAUGHAN, R. W. N80-15264
VECHIONE, W. J. N80-15731
VELA, R. R. N80-15472
N80-15474
VELUSWAMI, M. A. N80-15443
VENOSA, A. D. N80-16001
VERDEYEN, J. T. N80-15336
VERMILYEA, S. G. N80-15267
VEST, R. W. N80-15333
VICKERS, D. N80-15658
VISSCHER, W. M. N80-15324
VOGEL, W. J. N80-15308
VOLKOV, V. I. N80-15900
VONKARMAN, T. N80-15035
VONVALTIER, E. N80-15927
VUKOVICH, F. M. N80-15543
N80-15603
VYBOH, P. N80-15778

W

N80-15196
WADLINGER, E. A. N80-15855
WAGNER, J. A. N80-15273
WAINWRIGHT, T. E. N80-15928
WAITS, G. H. N80-15463
WALIGORA, J. M. N80-15788
N80-15791
N80-15792
WALKER, D. J. N80-15161
WALKER, H. M. N80-15678
WALKER, R. L. N80-15224
N80-15226
WALLACE, C. T. N80-15774
WALLACE, T. C. N80-15211
WALLER, R. A. N80-15426
WALSH, W. J. N80-15905
WANG, J. N80-15399
WANG, K. C. N80-15054
WANGEN, L. N80-15751
WARD, D. E. N80-16000
WARD, G. K. N80-15386
WARD, W. E. N80-15413
WARREN, J. L. N80-15220
N80-15912
WATSON, D. J. N80-15660
WAWNER, F. E., JR. N80-15210
WEATHERBEE, J. E. N80-15833
WEATHERILL, W. H. N80-15052
WEAVER, H. T. N80-15577

WEBER, E. J. N80-15717
WEED, R. M. N80-15306
WEGMANN, H. M. N80-15808
N80-15816
WEHMANEN, O. A. N80-15483
WEIBERG, J. A. N80-15067
WEIDERHOLD, G. N80-15985
WEIDHAAS, P. P. N80-15720
WEINBERG, I. N80-15557
N80-15558
WEINSTEIN, A. I. N80-15710
WEIR, E. E. N80-15676
WEISS, R. A. N80-15305
WEITZMAN, E. D. N80-15809
N80-15813
WEIZER, V. G. N80-15555
WELLMAN, D. L. N80-15758
WELSH, R. L. N80-15149
WELTE, D. N80-15155
WERDEN, R. G. N80-15589
WESCOTT, E. M. N80-15708
WESTBERRY, L. E. N80-15475
WESTBROOK, R. D. N80-15352
WHEELER, S. G. N80-15502
WHITAKER, A. F. N80-15562
WHITE, C. C. N80-15386
WHITE, C. W. N80-15352
WHITE, N. D. N80-15550
WHITE, T. T. N80-15473
WHITE, W. P. N80-15472
WHITEHEAD, V. S. N80-15458
N80-15489
N80-15510
WHITMOYER, R. A. N80-15159
WHITTEN, R. C. N80-15726
WIBERLY, S. E. N80-15076
WICKS, B. J. N80-15429
WIENKE, B. R. N80-15856
WIGHT, J. L. N80-15786
WILCOX, D. C. N80-15369
WILDER, D. C. N80-15899
WILKINSON, T. B. N80-15478
WILLIAMS, D. H. N80-15821
WILLIAMS, R. J. N80-16009
WILLIS, W. S. N80-15120
WILSON, D. G. N80-15415
WILSON, S. K. N80-15751
WILSON, S. W. N80-15836
WINDOM, H. L. N80-15774
WIRTH, P. N80-16010
WISCOMBE, W. J. N80-15923
WITHERSPOON, P. A. N80-15911
WITKOWSKI, J. M. N80-15999
WOLD, A. N80-15949
WOLF, R. A. N80-15712
WOO, H. J. C. N80-15733
WOOD, R. F. N80-15352
WOODEN, V. A. N80-15562
WOODRUFF, R. R. N80-15180
WOODS, D. N80-15652
WOODS, R. O. N80-15623
WOODWARD, D. S. N80-15153
WOOLLEY, S. K. N80-15489
WORNOM, D. N80-15651
WRIGHT, J. D. N80-15570
WRIGHT, R. S. N80-15673
WU, J. M. N80-15057
WU, S. M. N80-15851
WUENNENBERG, H. N80-15156
N80-15163
WYKES, J. H. N80-15073

Y

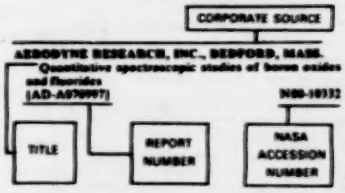
YAGER, W. C. N80-15380
YAO, S. S. N80-15494
YEAKLEY, P. L. N80-15055
YEGOROV, A. D. N80-15797
YEH, H. T. N80-15356
YODER, M. J. N80-15406
YOKELL, M. D. N80-15639
YOKSAN, S. N80-15966
YORK, E. N. N80-15029
YOUNG, M. E. N80-15976
N80-15990
YOUNG, R. T. N80-15352
YOUNGSDAHL, C. A. N80-15259
YUNG, S. C. N80-15672
YUNKER, R. R. N80-15999

Z

ZAHM, A. F. N80-15043
N80-15044
ZARNSTORFF, M. C. N80-15849
ZEISSE, C. R. N80-15339
ZEMACH, C. N80-15857
ZHURAVLEVA, T. N. N80-15798
ZIMMER, G. A. N80-15385
ZOLLARS, G. P. N80-15326
ZUBIETA, J. A. N80-15955
ZUCKERMAN, J. J. N80-15955
ZUMRUTKAYA, C. N80-15334
ZUPAN, J. M. N80-16000

CORPORATE SOURCE INDEX

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ABCOR, INC., WILMINGTON, MASS.
Statistical analysis of the source-receptor relationships for ozone and haze in the Houston area
[PB-299634/6] N80-15696

ACRES AMERICAN, INC., BUFFALO, N. Y.
Feasibility of compressed air energy storage as a peak shaving technique in California. Volume 2
[SAN-1331-T1] N80-15596
Feasibility of compressed air energy storage as a peak shaving technique in California. Volume 1: Executive summary
[SAN-1331-T2] N80-15636

ACUREX CORP., MOUNTAIN VIEW, CALIF.
Pilot scale evaluation of NOx combustion control for pulverized coal, phase 2
[PB-299325/1] N80-15687

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, NEUILLY-SUR-SEINE (FRANCE).
Technical evaluation report on the 28th Guidance and Control Panel Symposium on Advances in Guidance and Control Systems Using Digital Techniques
[AGARD-AR-148] N80-15140
Low cost aircraft flutter clearance
[AGARD-CP-278] N80-15141
Aerodynamic characteristics of controls
[AGARD-CP-262] N80-15149
Sleep, Wakefulness and Circadian Rhythm
[AGARD-LS-105] N80-15806

AEROJET LIQUID ROCKET CO., SACRAMENTO, CALIF.
Advanced oxygen-hydrocarbon rocket engine study
[NASA-CR-161350] N80-15203

AERONAUTICAL RESEARCH LABS., MELBOURNE (AUSTRALIA).
The application of image processing to the detection of corrosion by radiography
[ARL/MAT-REPT-109] N80-15421
The fracture of a parachute hook: A case study of the role of materials parameters in reliability analysis
[AR-001-591] N80-15429

AERONAUTICAL SYSTEMS DIV., WRIGHT-PATTERSON AFB, OHIO.
PRIME and PDQ sorts: Efficient minimal storage sorting algorithms
[AD-A071567] N80-15841

AEROSPACE CORP., EL SEGUNDO, CALIF.
Planar change heat conduction in general orthogonal curvilinear coordinates
[AD-A074896] N80-15969
The sudden commencement solar proton flux enhancement of 31 October 1972
[AD-A074546] N80-16017

AEROSPACE CORP., LOS ANGELES, CALIF.
Aerodynamic heating on a multi-hundred watt heat source based on wind tunnel tests
[AD-A074312] N80-15056

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Daytime visual acuity of observers through a window with and without binoculars
[AD-A074722] N80-15800

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[AD-A074691] N80-15734

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AFFDL experience in active control technology
N80-15159

AIR FORCE GEOPHYSICS LAB., HANSCOM AFB, MASS.
An atmospheric temperature profile measured with an in-situ infrared radiometer
[AD-A074471] N80-15713
Time and space variation of density in the tropics
[AD-A074472] N80-15714
Mixing in billow turbulence and stratospheric eddy diffusion
[AD-A074466] N80-15715
Airborne all-sky imaging of equatorial airglow
[AD-A073716] N80-15717
Cirrus particle distribution study, part 4
[AD-A074763] N80-15735

AIR FORCE HUMAN RESOURCES LAB., BROOKS AFB, TEX.
Effects of varying visual display characteristics of the T-4G, a T-37 flight simulator
[AD-A071410] N80-15180

AIR FORCE MATERIALS LAB., WRIGHT-PATTERSON AFB, OHIO.
Evaluation of 100 mm bore bearings after accelerated testing in a simulated space environment
[AD-A074527] N80-15413

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Electromagnetic pulse interaction notes: EMP 3-39
[AD-A074265] N80-15321

AIR POLLUTION TECHNOLOGY, INC., SAN DIEGO, CALIF.
Evaluation of granular bed filters for high-temperature/high-pressure particulate control
[PB-299199/8] N80-15672

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[CONS/3058-T1] N80-15591

ALABAMA UNIV., HUNTSVILLE.
A survey of photovoltaic systems
[NASA-CR-150696] N80-15563
An assessment of software quality assurance
[AD-A074213] N80-15843

ALABAMA UNIV., UNIVERSITY.
Heat pump centered integrated community energy systems: Systems development
[ANL/ICES-TM-30] N80-15588

ALASKA UNIV., FAIRBANKS.
Active experiments using rocket-borne shaped charge barium releases
[NASA-CR-162581] N80-15708
Airborne measurements of solar and planetary near ultraviolet radiation during the NASA/ESA CV-900 spacelab simulation
[NASA-CR-162566] N80-16012

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A research agenda on science and technology for the handicapped
[PB-301220/0] N80-16005

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Large momentum transfer electron scattering from few-nucleon systems
[SLAC-PUB-2373] N80-15890

AMES LAB., IOWA.
Effect of nitrogen concentration on temperature dependent mechanical properties of vanadium
[IS-M-195] N80-15248
Pulse and multiple pulse N.M.R. studies of crystallinity and molecular dynamics of solid state polymers
[IS-T-960] N80-15271
Bilocal field theory and a model for meson spectroscopy, part 1. Trident production by high energy charged particles on nuclei, part 2
[IS-T-861] N80-15889

APPLIED ELECTRONIC RESEARCH CORP., GAINESVILLE, FLA.
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[AD-A073010] N80-15954

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[PB-310245/7] N80-15648

ARGONNE NATIONAL LAB., ILL.
Photoelectron spectra of trinuclear metal cluster complexes
[CONF-790658-7] N80-15247
Long-term erosion monitoring of metallic conduits by ultrasonic pulse-echo techniques
[CONF-790480-1] N80-15259
Environmental planning and assessment for highway vehicle use to alcohol fuels
[CONF-790520-2] N80-15281
Liquid-liquid contact in vapor explosion
[ANL/RAS-78-37] N80-15285
Analysis of the multiphase inductor-converter bridge
[CONF-790622-26] N80-15350
Numerical procedure for calculating steady/unsteady, single-phase/two-phase three-dimensional fluid flow with heat transfer
[NUREG-CR-0782] N80-15376
Scale modeling of finite length fluid annular gaps for flow-induced vibration testing
[ANL-CT-79-40] N80-15436
Qualification of aluminum for OTEC heat exchangers
[ANL/OTEC-BCM-003] N80-15573
Stability considerations and a double-diffusive convection model for solar ponds
[ANL-CT-79-34] N80-15587
Heat pump centered integrated community energy systems: Systems development
[ANL/ICES-TM-30] N80-15588
Heat pump centered integrated community energy systems: System development
[ANL/ICES-TM-26] N80-15589
Lithium/iron sulfide batteries for electric vehicles
[CONF-781006-2] N80-15611
Development of Li-Al/FeS cells with LiCl-rich electrolyte
[CONF-7810135-2] N80-15614
Turbomachinery options for an underground pumped hydroelectric storage plant
[CONF-790803-50] N80-15629
OTEC physical and climatic environmental impacts
[CONF-790631-11] N80-15664
Charge separation in synthetic photo-reaction centers
[CONF-781048-1] N80-15784
Software development system for small dedicated and front-end microcomputer [LSI-11] applications
[CONF-7811112-1] N80-15848
Ergodic theorems for nonlinear contraction semigroups in a Hilbert space
[ANL-79-50] N80-15860
Equivalence between resolvent consistency and convergence for nonlinear quasi-contractive algorithms
[ANL-79-53] N80-15863
Technical support for open-cycle MHD program
[ANL/MHD-78-11] N80-15942
Fermi surface measurements in A-15 compounds
[CONF-790653-13] N80-15960
SCRAP: Theory and modeling considerations
[ANL-CT-79-49] N80-15997

ARIZONA STATE UNIV., TEMPE.
Conversion of cellulosic and waste polymer material to gasoline
[COO-2982-36] N80-15291
Multiple jet impingement heat transfer characteristic: Experimental investigation of in-line and staggered arrays with crossflow
[NASA-CR-3217] N80-15360
Imaging of surfaces and defects of crystals
[COO-2995-3] N80-15962

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[AD-A074465] N80-15918

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[AD-A074263] N80-15316

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[NASA-TP-1603] N80-15361

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[AD-A074890] N80-15662

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Advanced excitation techniques for tunable infrared lasers
[AD-A074732] N80-15390

ARMY INST. OF DENTAL RESEARCH, WASHINGTON, D. C.
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[AD-A074043] N80-15267

ARMY MISSILE COMMAND, REDSTONE ARSENAL, ALA.
Laser intracavity modulation and stabilization
[AD-A074879] N80-15395

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High speed function generation for research and project support
[AD-A073973] N80-15197
The use of classifiers and microprocessors for target identification on using millimeter wave signatures
[AD-A074840] N80-15317
Additional software developments for the HP-21 MX
[AD-A074068] N80-15846
Aerodynamic data base users guide
[AD-A074445] N80-15983

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Model 540 rotor blade crack propagation investigation
[AD-A074734] N80-15081

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[AD-A074128] N80-15078
Climatic chamber testing aircraft, engines armament and avionics; Test operations procedure
[AD-A074049] N80-15181

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[NASA-CR-3136] N80-15660

ARO, INC., ARNOLD AIR FORCE STATION, TENN.
Evaluation of the aerodynamic characteristics of a 1/20-scale A-10 model at Mach numbers from 0.30 to 0.75
[AD-A074867] N80-15055
Software techniques for the acquisition of optical data from a minicomputer-based image-intensifier-vidicon system
[AD-A074844] N80-15838

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The chemistry of Venus' atmosphere
[NASA-CR-159951] N80-16011

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Evaluation of the saturation resistant crosswind sensor
[AD-A074276] N80-15731
The 1702A GSRS, missile number 306, round number B-26, 9 July 1979
[AD-A073394] N80-15736
The 19701A GSRS, missile numbers 304, 305, 307, round numbers B-22, B-23, B-24, 5 July 1979
[AD-A073392] N80-15737
The 19702A GSRS, missile number 321, round number B-25, 9 July 1979
[AD-A073393] N80-15738
The 19701A GSRS, missile number 022, round number B-21, 5 Jul. 1979
[AD-A073391] N80-15739
The dynamics of material layers
[AD-A073728] N80-15740
The 1402228 Lance, missile number 4390, round number 334-AST
[AD-A073387] N80-15741
The 19304DT GSR, missile numbers 1070 and 1048, round numbers V-47 and V-48, 28 June 1979
[AD-A073389] N80-15742
The 19304B GSRS, missile numbers 1029, 1050, 1054, 1073, 1074, 1056, round numbers V-49, V-50, V-51, V-52, V-53, V-54, 2 July 1979
[AD-A073390] N80-15743

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[AD-A074746] N80-15391

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[REP-28945] N80-15257

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[UCRL-15058] N80-15182
Tripling of CO2 laser radiation in DHr, DCl and Sr
[CDO-4253-7] N80-15406

AXIOMATIX, LOS ANGELES, CALIF.
Shuttle orbiter S-band payload communications equipment design evaluation
[NASA-CR-160430] N80-15307

B

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Statistics of optical radiation scattered from rough surfaces
[AD-A074351] N80-15917

BATTELLE COLUMBUS LABS., OHIO.
Evaluation of worn SSME low pressure liquid oxygen turbopump bearing
[NASA-CR-161367] N80-15412
Chemical aspects of afterburner systems
[PB-290465/9] N80-15684
The cost of clean air and water report to Congress
[PB-300446/2] N80-15693
Evaluation of stationary source particulate measurement methods. Volume 5: Secondary lead smelters
[PB-300337/5] N80-15701

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Public policy issues in nuclear waste management
[PNL-2743] N80-15903

BEECH AIRCRAFT CORP., WICHITA, KANS.
The state-of-the-art of flutter substantiation procedures among US general aviation manufacturers
N80-15143

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Method of normalizing the measured scattered light from a surface defect located arbitrarily in a Gaussian intensity distribution incident on a surface
[BDX-613-2287] N80-15957

BENDIX CORP., TETERBORO, N. J.
Space construction base control system
[NASA-CR-161353] N80-15194

BOEING AEROSPACE CO., SEATTLE, WASH.
Fleet hardness variation
[AD-A074849] N80-15029
An extension of engine weight estimation techniques to compute engine production cost
[AD-A074454] N80-15135
The YC-14 upper surface blown flap: A unique control surface
N80-15157
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[NASA-CR-160442] N80-15195

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N80-15154

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[AD-A075612] N80-15077

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[AD-A074848] N80-15541

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N80-15161

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The minimum cost approach to flutter clearance
N80-15148

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[BNL-24811] N80-15225
High temperature electrolysis
[BNL-26331] N80-15227
Modifications in optoelectronic behavior of plasma-deposited amorphous semiconductor alloys via impurity incorporation
[BNL-26646] N80-15255
Proceedings of the Hydride Storage Reservoir Symposium/Workshop
[BNL-26523] N80-15286
Partial discharge performance of lapped plastic insulation for superconducting power transmission cables and the dielectric strength of supercritical helium gas
[BNL-24779] N80-15346
Response characteristics of optical probes
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Principles, calibration and process experience for a new laser aerosol detector system
[BNL-29018] N80-15403
MARKAL. A multiperiod linear-programming model for energy systems analysis [BNL version]
[BNL-26390] N80-15636
Correlation between wave slopes and near-surface ocean currents
[BNL-25066] N80-15773
Numerical methods for Helmholtz type equations in unbounded regions
[BNL-26543] N80-15858
Fusion energy for hydrogen production
[BNL-24908] N80-15897

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[NASA-CR-160442] N80-15195

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[AD-A073998] N80-15940

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[PB-299568/6] N80-15544

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[PB-299536/3] N80-15548

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[PB-300904/0] N80-15804

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[NASA-CR-159955] N80-15705

C

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Leading edge flutter of a supercavitating hydrofoil
[AD-A074636] N80-15301
Dynamics of vortices and shock waves in nonuniform media
[AD-A072842] N80-15366
Physics of mantle and core minerals
[E80-10034] N80-15532
Photochemical aerosol dynamics
[PB-299212/1] N80-15695

CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Experimental study of combustion in a turbulent boundary layer
[LBL-8946] N80-15218
Effects of air melting on Fe/0.3/3Cr/0.5Mo/2Mn and Fe/0.3C/3Cr10.5Mo/2Ni structural alloy steels
[LBL-9103] N80-15243
Design of duplex low-carbon steels with carbide forming elements
[LBL-8628] N80-15244
Forced two phase helium cooling of large superconducting magnets
[LBL-9701] N80-15373
Geothermal energy development from the Salton Trough to the High Cascades
[LBL-8703] N80-15568
Aquifer thermal energy storage
[LBL-7070] N80-15618
ARMA models for earthquake ground motions
[UCRL-15084] N80-15719
Special session on vision
[LBL-9160] N80-15802
Finite element method for the solution of a potential theory integral equation
[LBL-9504] N80-15859
Heavy ion collisions at relativistic energies
[LBL-9494] N80-15888
Prospects for high energy heavy ion accelerators
[LBL-8899] N80-15898
Angular momentum and the collective modes excited in deep-inelastic processes and in fission
[LBL-9173] N80-15904
Rock mass characterization for storage of nuclear waste in granite
[LBL-8570] N80-15911
Ray and wave optics of integrable and stochastic systems
[LBL-9465] N80-15921
Equilibrium and stability in strongly inhomogeneous plasmas
[LBL-8528] N80-15929

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[UCRL-15033] N80-15930

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[UCRL-52577] N80-15212
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[UCRL-81843] N80-15213
DYNSYL: A general-purpose dynamic simulator for chemical processes
[UCRL-52567] N80-15219
Tantalum fabrication
[UCID-18152] N80-15256
Environmentally enhanced crazing in polymers
[UCRL-82488] N80-15272
Simulation of LNG vapor spread and dispersion by finite element methods
[UCRL-82441] N80-15282
Cryogenic hydrogen data pertinent to magnetic fusion energy
[UCRL-52628] N80-15292
Elastic-plastic analyses for seismic reserve capacity in power plant braced frames
[UCRL-52614] N80-15303
Very fast, high-peak-power, planar triode amplifiers for driving optical gates
[UCRL-82538] N80-15358
Vessel discharge by friction dominated tube flow
[UCRL-82801] N80-15375
Wave propagation in viscoelastic media
[UCRL-83019] N80-15378
Micro-fresnel structures for microscopy of laser generated bright X-ray sources
[UCRL-82684] N80-15401
Compact 5 x 10-12 AMP/SEC rail-gun pulser for a laser plasma shutter
[UCRL-82539] N80-15407
Applying a compensated pulsed alternator to a flashlamp load for NOVA
[UCRL-82473] N80-15408
Hugoniot elastic limits and compression parameters for brittle materials
[UCRL-83020] N80-15437
Novel scheme for making cheap electricity with nuclear energy
[UCID-18153-REV-1] N80-15564
Analytical modeling of heat pump units as a design aid and for performance prediction
[UCRL-52618] N80-15610
Laminated disk flywheel program
[UCRL-81772] N80-15612
Environmental overview of geothermal development: The Geysers-Calistoga KGRA. Volume 1: Issues and recommendations
[UCRL-52496-VOL-1] N80-15626
L.L.L. materials program for fiber-composite flywheels
[UCRL-83043] N80-15632
Man's effect on stratospheric ozone
[UCRL-82556] N80-15666
Identification of environmental control technologies for geothermal development in the Imperial Valley of California
[UCRL-52543] N80-15668
Global observation of atmospheric ozone by satellite
[UCRL-82028] N80-15720
REBEL/BASIC: Language, a user's guide
[UCRL-52668] N80-15849
Scaled hydrogenic approximation wave functions
[UCID-18167] N80-15881
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[UCID-18125] N80-15894
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[UCRL-52522] N80-15896
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[UCRL-52796] N80-15899
Thermal-stress analysis of rock formations for nuclear fuel and waste storage
[UCRL-81992] N80-15910
Energy coupling in the plasma focus
[UCRL-81907] N80-15928
Superconductivity for mirror fusion
[UCRL-81693] N80-15933
Near and long term pulse power requirements for laser driven inertial confinement fusion
[UCRL-82661] N80-15938
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[UCRL-82142] N80-15939
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[UCRL-52553-VOL-2] N80-15995
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[PPG-422] N80-15935
Institutional barriers to wastewater reuse
[PB-299027/3] N80-16002
CALIFORNIA UNIV., RIVERSIDE.
Theory of low dimensional superconductors
[SAN-0034-T5] N80-15354
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[SAN-0034-T4] N80-15966
CALIFORNIA UNIV., SAN DIEGO, LA JOLLA.
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[CONF-790653-13] N80-15960
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Manual interpretation of LANDSAT data
N80-15460
Development of partitioning as an aid to spectral signature extension
N80-15499
Manual LANDSAT data analysis for crop type identification
N80-15504
CALSPAN ADVANCED TECHNOLOGY CENTER, BUFFALO, N.Y.
Design criteria for optimal flight control systems
[AD-A074092] N80-15139
CANADA CENTRE FOR REMOTE SENSING, OTTAWA (ONTARIO).
Use of thermal infrared and colour infrared imagery to detect crop moisture stress
[E80-10056] N80-15530
HCMM/soil moisture experiment
[E80-10037] N80-15531
CATHOLIC UNIV. OF AMERICA, WASHINGTON, D. C.
Concept development of automated image analysis. Automated contour recognition and classification in aerial photography by means of angles and curvature
[AD-A074439] N80-15540
CENTRE DE RECHERCHES DU SERVICE DE SANTE DES ARMEES, LYONS (FRANCE).
Vigilance and attention
N80-15811
Psychostimulants
N80-15817
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, PARIS (FRANCE).
Circadian and circannual rhythms in healthy adults
N80-15807
Tolerance to shift work: A chronologic approach
N80-15815
CITY COLL. OF THE CITY UNIV. OF NEW YORK.
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[NASA-CR-162572] N80-15728
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[AD-A074337] N80-15732
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[NASA-CR-159185] N80-15205
Energy conservation through point source recycle with high temperature hyperfiltration
[PB-299183/4] N80-15688
CNR, INC., NEEDHAM, MASS.
HF modem evaluations for the Advanced Narrowband Digital Voice Terminal [ANDVT]
[AD-A073674] N80-15323
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[COO-4258-1] N80-15284
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[COO-2577-17] N80-15616
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[AD-A074985] N80-15389
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[AD-A074070] N80-15370
CONNECTICUT UNIV., STORRS.
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[PB-299168/5] N80-15419
Use of indicator species of algae to determine water quality
[PB-299953/0] N80-15694
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Diffusion coefficients from Metrac system turbulence measurements
[PB-300339/9] N80-15763
CORNELL UNIV., ITHACA, N. Y.
Inelastic analysis of transverse deflection of plates by the boundary element method
[COO-2733-24] N80-15438
Temporal and spatial power spectrum studies of numerical simulations of type 2 gradient drift irregularities in the equatorial electrojet
[AD-A073467] N80-15716
Comparison of boundary element and finite element methods in two-dimensional inelastic analysis
[COO-2733-22] N80-15864
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Correlation and estimation of hydrocarbon vapour-liquid equilibrium constants and application in the calculation of dew- and bubble points of multicomponent mixtures
[PB-300471/7] N80-15230
Two-phase vapour-liquid flow with phase change, review
[PB-299905] N80-15379
Data acquisition and reduction for a high-resolution field ionisation mass spectrometer
[PB-299936/5] N80-15388
CURTISS-WRIGHT CORP., WOOD-RIDGE, N.J.
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears test program
[NASA-CR-134669] N80-15103
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears bearing development program
[NASA-CR-134898] N80-15105
Quiet Clean Short-haul Experimental Engine [QCSEE] main reduction gears detailed design report
[NASA-CR-134872] N80-15106

D

DAMES AND MOORE, WHITE PLAINS, N. Y.
Applicability of a generic monitoring program for radioactive waste burial grounds at Oak Ridge National Laboratory and Idaho National Engineering Laboratory
[ORNL/SUB-7167-1] N80-15095
DAYTON UNIV. RESEARCH INST., OHIO.
A first look at the effect of severe rainfall upon an aircraft
[NASA-CR-162569] N80-15058
DCW INDUSTRIES, STUDIO CITY, CALIF.
Development of an alternative to the E9 procedure for predicting boundary-layer transition
[AD-A074071] N80-15369
DEPARTMENT OF AGRICULTURE, COLUMBIA, MD.
Econometric models for predicting confusion crop ratios
N80-15450
DEPARTMENT OF AGRICULTURE, HOUSTON, TEX.
USDA analyst review of the LACIE IMAGE-100 hybrid system test
N80-15467
LACIE area, yield, and production estimate characteristics: *U.S.S.R.*
N80-15485
The vegetative index number and crop identification
N80-15503
Functional definition and design of a USDA system
N80-15521
Data base design for a worldwide multicrop information system
N80-15522
Resource modeling: A reality for program cost analysis
N80-15524
The application test system: Experiences to date and future plans
N80-15525
DEPARTMENT OF AGRICULTURE, PHOENIX, ARIZ.
Heat Capacity Mapping Mission [HCMM]
[E80-10039] N80-15533
DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.
Economic evaluation: Concepts, selected studies, system costs, and a proposed program
N80-15490
Response of selected plant and insect species to simulated SRM exhaust mixtures and to exhaust components from SRM fuels
N80-15657
DEPARTMENT OF ENERGY, BARTLESVILLE, OKLA.
Emissions characteristics of six high-speed diesel engines
[BETC/TPR-78/7] N80-15667
DEPARTMENT OF ENERGY, WASHINGTON, D. C.
Analysis of hydrogen in solids
[DOE/ER-0026] N80-15220
Project planning document: High vechicle Alternative Fuels Utilization Program [AFUP]
[DOE/CS-0093] N80-15279
Ethanol/gasoline blends as automotive fuels
[CONF-790520-5] N80-15280
Commercialization strategy report for recovery of natural gas from unconventional sources
[TID-28948-DRAFT] N80-15287
Report of the Alcohol Fuel Policy Review
[DOE/PE-0012] N80-15290
The 1985, 1990 and 1995 midterm energy market model results under three scenarios of Fuel Use Act regulations
[DOE/EIA-0182/2] N80-15592

Energy supply and demand in the short term: 1979 and 1980
[DOE/EIA-0184/4] N80-15593
International energy assessment
[DOE/EIA-0184/1] N80-15594
National program plan for passive and hybrid solar heating and cooling
[DOE/CS-0089] N80-15598
Nuclear strategy of the Department of Energy
[DOE/ER-0025/D] N80-15605
All-union scientific and technical conference on use of the earth's heat for the production of electric power - summary of reports
[CONF-751270-SUMM] N80-15615
Environmental development plan ocean thermal energy conversion
[DOE/EDP-0034] N80-15621
Federal Energy Data System [FEDS] statistical summary update
[DOE/EIA-0192] N80-15630
Energy demand in the developing countries
[DOE/EIA-0183/80] N80-15631
Federal leasing and outer continental shelf energy production goals
[DOE/RA-0037] N80-15640
Environmental development plan photovoltaics
[DOE/EDP-0031] N80-15643
Environmental development plan: Electric Energy Systems
[DOE/EDP-0038] N80-15669
Fusion energy program of the U.S. Department of Energy, FY 1980
[DOE/ET-0089] N80-15893
Report to Congress on the economic impact of energy actions as required by public law 93-275, section 18-d
[DOE/PE-0007] N80-15993

DETROIT DIESEL ALLISON, INDIANAPOLIS, IND.
Plasma-sprayed dual density ceramic turbine seal system
[NASA-CR-159739] N80-15411

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, BONN [WEST GERMANY].
Circadian rhythms of human performance and resistance: Operational aspects
N80-15808
Circadian rhythms in air operations
N80-15816

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, BRUNSWICK [WEST GERMANY].
Theoretical aerodynamic methods for active control devices
N80-15150
Roll control by digitally controlled segment spoilers
N80-15156
In-flight measured characteristics of combined flap-spoiler direct lift controls
N80-15165

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, GOETTINGEN [WEST GERMANY].
An empirical approach for checking flutter stability of gliders and light aircraft
N80-15144
A simplified ground vibration test procedure for sailplanes and light aircraft
N80-15146

DORNIER-WERKE G.M.B.H., FRIEDRICHSHAFEN [WEST GERMANY].
Wind tunnel measurements and analysis of some unusual control surfaces on two swept wing fighter configurations
N80-15155
Direct side force and drag control with the aid of pylon split flaps
N80-15163

DOUGLAS AIRCRAFT CO., INC., LONG BEACH, CALIF.
A higher order panel method for three-dimensional potential flow
[AD-A074751] N80-15368

DRAVO CORP., PITTSBURGH, PA.
Management of coal preparation fine wastes without disposal ponds
[PB-299100/5] N80-15691

E

EAST-WEST COMMUNICATION INST., HONOLULU, HAWAII.
Satellite television in Indonesia
[PB-299524/9] N80-15328

ECONOMICS, STATISTICS AND COOPERATIVES SERVICE, WASHINGTON, D. C.
Obtaining timely crop area estimates using ground-gathered and LANDSAT data
[PB-300825/7] N80-15549

EG AND G WASHINGTON ANALYTICAL SERVICES CENTER, RIVERDALE, MD.
Precise relative location estimation from satellite laser observations
[NASA-CR-159953] N80-15536

EIC, INC., NEWTON, MASS.
Corrosion protection of solar-collector heat exchangers with electrochemically deposited films
[COO-4297-1] N80-15569

ELECTRIC POWER RESEARCH INST., PALO ALTO, CALIF.
Feasibility study for enhancing the development of fusion energy
[EPRI-ER-778-SR] N80-15642

ELECTRONICS RESEARCH LAB., ADELAIDE (AUSTRALIA).
Liquid phase epitaxial growth of gallium arsenide
[AR-001-666] N80-15947

ENGINEERING-SCIENCE, INC., MCLEAN, VA.
Inventory of resources with emissions greater than 100 tons/year subject to organic material regulations in metropolitan Boston AQCR
[PB-298879/8] N80-15692

ENVIRONMENTAL DATA AND INFORMATION SERVICE, WASHINGTON, D. C.
Development of LACIE CCEA-1 weather/wheat yield models
N80-15457
International Decade of Ocean Exploration, volume 7
[NOAA-S/T-78-211-VOL-7] N80-15772

ENVIRONMENTAL MONITORING AND SUPPORT LAB., LAS VEGAS, NEV.
Western energy sulfate/nitrate monitoring network
[PB-299238/6] N80-15685

ENVIRONMENTAL PROTECTION AGENCY, ANN ARBOR, MICH.
Effects of inspection and maintenance programs on fuel economy
[PB-297583/7] N80-15420
Investigation of the effects of the installation of an oxidation catalyst on a diesel powered vehicle
[PB-299928/2] N80-15699

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.
Compliance status of major air pollution facilities
[PB-299959/7] N80-15700

ENVIRONMENTAL RESEARCH INST. OF MICHIGAN, ANN ARBOR.
Feature extraction applied to agricultural crops as seen by LANDSAT
N80-15497
Compensation for atmospheric effects in LANDSAT data
N80-15498
Signature extension methods in crop area estimation
N80-15501
Analysis of scanner data for crop inventories
[E80-10040] N80-15534

ENVIRONMENTAL RESEARCH LAB., GULF BREEZE, FLA.
American-Soviet Symposium on Chemical Pollution of the Marine Environment, 1st
[PB-298343/5] N80-15683

F

FLORIDA STATE UNIV., TALLAHASSEE.
Atmospheric structural variations that result in upwelling off Oregon
[PB-301240/8] N80-15768

FLORIDA TECHNOLOGICAL UNIV., ORLANDO.
Ecological baseline studies
N80-15658

FLORIDA UNIV., GAINESVILLE.
Radiation chemistry of hydrocarbon and alkyl halide systems
[ORO-3106-71] N80-15222
Influence of clouds on UV-B penetration to the earth's surface
[NASA-CR-160428] N80-15703

FORD AEROSPACE AND COMMUNICATIONS CORP., HOUSTON, TEX.
The application test system: Technical approach and system design
N80-15523

FORD AEROSPACE AND COMMUNICATIONS CORP., PALO ALTO, CALIF.
Preliminary design of a network virtual data base system
[AD-A074205] N80-15986

FOREIGN RESOURCES ASSOCIATES, FORT COLLINS, COLO.
Evaluation of forgeability of steels by notch compression method
[RFP-TRANS-273] N80-15249

G

GENERAL ACCOUNTING OFFICE, WASHINGTON, D. C.
Aircraft delays at major US airports can be reduced
[PB-299442/4] N80-15061
Fusion: A possible option for solving long-term energy problems
[PB-300692/1] N80-15946
Improving the scientific and technical information available to the Environmental Protection Agency in its decision making process
[PB-300580/8] N80-16003

GENERAL APPLIED SCIENCE LABS., INC., WESTBURY, N. Y.
Conceptual design and performance estimates for a supersonic aerodynamic window for the ATA vacuum system aperture
[UCRL-15051] N80-15183

GENERAL ATOMIC CO., SAN DIEGO, CALIF.
Aging behavior of alloy 800H and associated mechanical property changes
[GA-A-15194] N80-15251

GENERAL DYNAMICS/CONVAIR, SAN DIEGO, CALIF.
General Dynamics Convair Division approach to structural analysis of large superconducting coils
[UCRL-15975] N80-15357

GENERAL ELECTRIC CO., CINCINNATI, OHIO.
Demonstration of short haul aircraft aft noise reduction techniques on a twenty inch [50.8 cm] diameter fan, volume 3
[NASA-CR-134851] N80-15085
Quiet Clean Short-haul Experimental Engine [QCSEE] Over The Wing [OTW] design report
[NASA-CR-134848] N80-15086
Quiet Clean Short-haul Experimental Engine [QCSEE]. Aerodynamic and aeromechanical performance of a 50.8 cm [20 inch] diameter 1.34 PR variable pitch fan with core flow
[NASA-CR-135017] N80-15087
Quiet Clean Short-haul Experimental Engine [QCSEE] preliminary under the wing flight propulsion system analysis report
[NASA-CR-134868] N80-15088
Quiet Clean Short-haul Experimental Engine [QCSEE]. The aerodynamic and mechanical design of the QCSEE over-the-wing fan
[NASA-CR-134915] N80-15089
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine digital control system design report
[NASA-CR-134920] N80-15090
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine simulation report
[NASA-CR-134916] N80-15091
Quiet Clean Short-haul Experimental Engine [QCSEE] over-the-wing control system design report
[NASA-CR-135337] N80-15092
Quiet Clean Short-haul Experimental Engine [QCSEE]. Core engine noise measurements
[NASA-CR-135166] N80-15093
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] engine composite nacelle test report. Volume 1: Summary, aerodynamic and mechanical performance
[NASA-CR-159471] N80-15094
Quiet Clean Short-haul Experimental Engine [QCSEE] preliminary over-the-wing flight propulsion system analysis report
[NASA-CR-135296] N80-15095
Quiet Clean Short-haul Experimental Engine [QCSEE]. Under-The-Wing [UTW] engine boilerplate nacelle test report, volume 1
[NASA-CR-135249] N80-15096
Quiet Clean Short-haul Experimental Engine [QCSEE]. Under-The-Wing [UTW] engine boilerplate nacelle test report. Volume 3: Mechanical performance
[NASA-CR-135251] N80-15097
Quiet Clean Short-haul Experimental Engine [QCSEE]. Composite fan frame subsystem test report
[NASA-CR-135010] N80-15098
Quiet Clean Short-haul Experimental Engine [QCSEE] Over-The-Wing [OTW] boilerplate nacelle design report
[NASA-CR-135168] N80-15099
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] composite nacelle subsystem test report
[NASA-CR-135075] N80-15100
Quiet Clean Short-haul Experimental Engine [QCSEE]. Ball spline pitch change mechanism design report
[NASA-CR-134873] N80-15101
Acoustic analysis of aft noise reduction techniques measured on a subsonic tip speed 50.8 cm [twenty inch] diameter fan
[NASA-CR-134891] N80-15102
Quiet Clean Short-haul Experimental Engine [QCSEE] clean combustor test report
[NASA-CR-134916] N80-15104
Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine composite fan blade design report
[NASA-CR-135046] N80-15108
Quiet Clean Short-haul Experimental Engine [QCSEE]: The aerodynamic and mechanical design of the QCSEE under-the-wing fan
[NASA-CR-135009] N80-15109
Quiet Clean Short-haul Experimental Engine [QCSEE] composite fan frame design report
[NASA-CR-135278] N80-15110
Quiet Clean Short-haul Experimental Engine [QCSEE] UTW fan preliminary design
[NASA-CR-134842] N80-15111
Quiet Clean Short-haul Experimental Engine [QCSEE]: The aerodynamic and preliminary mechanical design of the QCSEE OTW fan
[NASA-CR-134841] N80-15112

Quiet Clean Short-haul Experimental Engine [QCSEE] under-the-wing engine composite fan blade design
[NASA-CR-134846] N80-15113
Quiet Clean Short-haul Experimental Engine [QCSEE] over-the-wing engine acoustic simulation results
[NASA-CR-135049] N80-15114
Quiet Clean Short-Haul Experimental Engine [QCSEE] ball spline pitch-change mechanism whirlig test report
[NASA-CR-135354] N80-15115
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] boiler plate nacelle and core exhaust nozzle design report
[NASA-CR-135008] N80-15116
Quiet Clean Short-haul Experimental Engine [QCSEE] Over-The-Wing [OTW] propulsion systems test report. Volume 4: Acoustic performance
[NASA-CR-135326] N80-15118
Quiet Clean Short-haul Experimental Engine [QCSEE] Under-The-Wing [UTW] composite nacelle
[NASA-CR-135352] N80-15119
Quiet Clean Short-haul Experimental Engine [QCSEE]
[NASA-CR-159473] N80-15120
Quiet Clean Short-haul Experimental Engine [QCSEE]. Double-annular clean combustor technology development report
[NASA-CR-159483] N80-15121
Quiet Clean Short-Haul Experimental Engine [QCSEE]: Acoustic treatment development and design
[NASA-CR-135266] N80-15122
Quiet Clean Short-Haul Experimental Engine [QSCEE]. Preliminary analyses and design report, volume 1
[NASA-CR-134838] N80-15123
Quiet Clean Short-Haul Experimental Engine [QCSEE]. Preliminary analyses and design report, volume 2
[NASA-CR-134839] N80-15124
Quiet Clean Short-Haul Experimental Engine [QCSEE] Over-The-Wing [OTW] propulsion system test report. Volume 1: Summary report
[NASA-CR-135323] N80-15125
Quiet Clean Short-Haul Experimental Engine [QCSEE] Over-The Wing [OTW] propulsion system test report. Volume 3: Mechanical performance
[NASA-CR-135325] N80-15126

GENERAL ELECTRIC CO., FAIRFIELD, CONN.
Solar power satellite system definition study. Volume 1: Executive summary
[NASA-CR-160442] N80-15195

GENERAL ELECTRIC CO., HOUSTON, TEX.
Weightlessness
N80-15795

GENERAL ELECTRIC CO., HUNTSVILLE, ALA.
Data base management system configuration specification
[NASA-CR-161351] N80-15825

GENERAL ELECTRIC CO., PHILADELPHIA, PA.
Sintered silicon nitrode recuperator fabrication
[NASA-CR-159706] N80-15263
Pressure Modulator Radiometer [PMR] tests
[NASA-CR-159175] N80-15380

GENERAL ELECTRIC CO., SCHENECTADY, N. Y.
Nitrogen-strengthened austenitic stainless steel for cryogenic magnet structures
[CONF-790815-13] N80-15258

GENERAL ELECTRIC CO., ST. PETERSBURG, FLA.
Gold plating metallized alumina ceramics
[GEPP-TIS-380] N80-15254
Displacement characteristics of a glass-ceramic insulator in a vacuum tube envelope sealing process
[GEPP-TIS-445] N80-15269
Obtaining numerical values for the elliptic emission functions used in calculating electron emission from surfaces
[GEPP-TIS-443] N80-15961

GENERAL ELECTRIC CO., WASHINGTON, D. C.
Demonstration of short-haul aircraft aft noise reduction techniques on a twenty inch [50.8 cm] diameter fan, volume 1
[NASA-CR-134849] N80-15083
Demonstration of short-haul aircraft aft noise reduction techniques on a twenty inch [50.8] diameter fan, volume 2
[NASA-CR-134850] N80-15084

GENERAL RESEARCH CORP., MCLEAN, VA.
Analysis to determine functional and systems requirements for an on-line Structure and Composition System [SACS]. Report of task E: Analysis of current and developing systems which interface with LOGSACS and PERSACS to determine to what extent they do or do not support the data requirements of an on-line SACS
[AD-A074638] N80-15868

GEOLOGICAL SURVEY, BAY SAINT LOUIS, MISS.
One-dimensional steady-state stream water-quality model
[PB-300327/4] N80-15677
Estimating the gas and dye quantities for modified tracer technique measurement of stream reaeration coefficients
[PB-299015/8] N80-15690

GEOLOGICAL SURVEY, LAKEWOOD, COLO.
Quantity and quality of urban runoff from three localities in the Denver metropolitan area, Colorado
[PB-299859/9] N80-15691

GEOLOGICAL SURVEY, RESTON, VA.
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1
[E80-10031] N80-15526
US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range Project 8: Conservation of natural areas and of the genetic material they contain
[PB-297931/8] N80-15547

GEOLOGICAL SURVEY, TUCSON, ARIZ.
Statistical summaries of Arizona streamflow data
[PB-299354/1] N80-15550

GEORGIA INST. OF TECH., ATLANTA.
Theoretical investigation of the excitation structure and optical properties of titanium, vanadium and their oxides
[AD-A074222] N80-15241
Effect of infrared radiation on compaction of municiple wastewater sludges
[PB-298296/5] N80-15998

GILBERT ASSOCIATES, INC., READING, PA.
Research and evaluation of biomass resources/conversion/utilization systems [market/experimental analysis for development of a data base for a fuels from biomass model]
[COO-5022-5] N80-15576

GRUMMAN AEROSPACE CORP., BETHPAGE, N.Y.
Manned geosynchronous mission requirements and systems analysis study. Volume 1: Executive summary
[NASA-CR-160429] N80-15196
Manned Orbital Transfer Vehicle [MOTV]. Volume 2: Mission handbook
[NASA-CR-160430] N80-15187
Manned Orbital Transfer Vehicle [MOTV]. Volume 3: Program requirements documents
[NASA-CR-160431] N80-15188
Manned Orbital Transfer Vehicle [MOTV]. Volume 4: Supporting analysis
[NASA-CR-160432] N80-15189
Manned Orbital Transfer Vehicle [MOTV]. Volume 5: Turnaround analysis
[NASA-CR-160433] N80-15190
Manned Orbital Transfer Vehicle [MOTV]. Volume 6: Five year program plan
[NASA-CR-160434] N80-15191
Solar power satellite system definition study. Volume 1: Executive summary
[NASA-CR-160442] N80-15195

GULF SOUTH RESEARCH INST., NEW ORLEANS, LA.
Toxic polypeptides and uremia
[PB-301063/4] N80-15803

GURNHAM AND ASSOCIATES, INC., CHICAGO, ILL.
Performance evaluation of the existing three lagoon wastewater treatment plant at Pawnee, Illinois
[PB-299740/1] N80-16006

H

HAGEMAN, INC., FORT WORTH, TEX.
Development of a quality assurance methodology for the technical information generation subsystem of NTIPS
[AD-A074299] N80-15984

HAMILTON STANDARD, WINDSOR LOCKS, CONN.
Quiet Clean Short-haul Experimental Engine [QCSEE]: Hamilton Standard cam/harmonic drive variable pitch fan actuation system detail design report
[NASA-CR-134852] N80-15107
Quiet Clean Short-haul Experimental Engine [QCSEE] whirl test of cam/harmonic pitch change actuation system
[NASA-CR-135140] N80-15117

HARRY DIAMOND LABS., ADELPHI, MD.
Characteristics of orotron oscillation and amplification. 1. Power and frequency characteristics
[AD-A074761] N80-15337
A reflex triode with geometric focusing
[AD-A074453] N80-15341
QINTEG: A program for computing Gaussian quadrature coefficients
[AD-A073974] N80-15845

HARVARD MEDICAL SCHOOL, BOSTON, MASS.
Biological rhythms of man living in isolation from time cues
N80-15813

HARVARD UNIV., CAMBRIDGE, MASS.
Integrability conditions for the existence of a Lagrangian in Newtonian mechanics and field theory
[COO-4742-1] N80-15972

HAWAII STATE DEPT. OF PLANNING AND ECONOMIC DEVELOPMENT, HONOLULU.
Solar/wind handbook for Hawaii: Technical applications for Hawaii, the Pacific Basin and sites worldwide with similar climatic conditions
[UCRL-15053] N80-15628

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[NASA-CR-162583] N80-16015

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[UCRL-15053] N80-15628

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[UCRL-15053] N80-15628

HIGGINS, AULD AND ASSOCIATES, ALBUQUERQUE, N. MEX.
Analysis of field test results for single-axis-tracking solar collector foundations
[SAND-79-7023] N80-15586

HITTMAN ASSOCIATES, INC., COLUMBIA, MD.
Environmental assessment report: Solvent Refined Coal [SRC] systems
[PB-300383/7] N80-15676

HONEYWELL ELECTRO-OPTICS CENTER, LEXINGTON, MASS.
Cloud Top Scanning radiometer [CTS]
[NASA-CR-159954] N80-15381

HONEYWELL SYSTEMS AND RESEARCH CENTER, MINNEAPOLIS, MINN.
Rationale for the design of the ADA programming language: Volume 14, no. 6, part B
[AD-A073854] N80-15842

HOUSTON UNIV., TEX.
Linear feature selection with applications
N80-15496

HUGHES AIRCRAFT CO., CULVER CITY, CALIF.
High energy Optical Resonance Transfer Laser study. Volume 1: Laboratory experiments
[AD-A074126] N80-15399

HYDROCOMP, INC., PALO ALTO, CALIF.
Watershed erosion and sediment transport model
[PB-299070/3] N80-15551

I

IBM FEDERAL SYSTEMS DIV., HOUSTON, TEXAS.
The LACIE data bases: Design considerations
N80-15475
Man-machine interfaces in LACIE/ERIPS
N80-15476
LACIE/ERIPS software system summary
N80-15477
A look at computer system selection criteria
N80-15480

IBM WATSON RESEARCH CENTER, YORKTOWN HEIGHTS, N.Y.
Time-resolved spectroscopic studies of surface reactions
[AD-A074952] N80-15216

ICHTHYOLOGICAL ASSOCIATES, INC., ABSECON, N.J.
Review of water intake screening options for coastal water users with recommendations for Ocean Thermal Energy Conversion [OTEC] plants
[ANL/OTEC-BCM-005] N80-15572

IDAHO NATIONAL ENGINEERING LAB., IDAHO FALLS.
Performance evaluation of a drag-disc turbine transducer and three-beam gamma densitometer under transient two-phase flow conditions
[CONF-790423-15] N80-15384
Environmental surveillance report for the INEL radioactive waste management complex
[TREE-1357] N80-15909

IIT RESEARCH INST., CHICAGO, ILL.
Biological effects of high-voltage electric fields, an update. Volume 2: Bibliography
[EPRI-EA-1123-VOL-2] N80-15801

ILLINOIS UNIV. AT CHICAGO CIRCLE, CHICAGO.
Topographic examination of semiconductor systems
[AD-A075007] N80-15953

ILLINOIS UNIV. AT URBANA-CHAMPAIGN.
Low temperature electron irradiation and annealing of pure cadmium
[COO-1198-1274] N80-15246
Low pressure, high voltage discharges for the production of energetic electron beams
[AD-A074556] N80-15336
Preliminary study of a recoil mechanism using Coulomb friction
[AD-A074203] N80-15414
On 1/N expansions and the phased diagram of discrete lattice gauge theories with matter fields
N80-15968

ILLINOIS UNIV., URBANA.
Activation volumes of some superionic conductors with the fluorite structure
[COO-1198-1264] N80-15349
Stability considerations and a double-diffusive convection model for solar ponds
[ANL-CT-79-34] N80-15587
Energy optimal use of waste paper
[COO-2693-9] N80-15595
Monte Carlo simulation of neutral-beam injection for mirror fusion reactors
[COO-2218-133] N80-15932

INDUSTRIAL ENVIRONMENTAL RESEARCH LAB., RESEARCH TRIANGLE PARK, N. C.
In-stack plume opacity from electrostatic precipitator/scrubber system at Harrington Unit 1 [PB-299215/4] N80-15686
INDUSTRY AND TRADE ADMINISTRATION, WASHINGTON, D.C.
Production of iron by direct reduction [PB-300533/7] N80-15262
INSTITUTE OF GAS TECHNOLOGY, CHICAGO, ILL.
LNG industry: An overview of projects and costs [CONF-7811112-2] N80-15278
Application analysis of solar total energy systems to the residential sector. Volume 4: Market penetration [ALO-3787-4] N80-15597
Prediction of current distribution in a molten carbonate fuel cell [CONF-781063-1] N80-15613
INSTITUTO GEOGRAFICO NACIONAL, MADRID (SPAIN).
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [ERO-10032] N80-15527
INTERNATIONAL BUSINESS MACHINES CORP., GAITHERSBURG, MD.
On-board multispectral classification study. Volume 2: Supplementary tasks [NASA-CR-159176] N80-15539
INTERNATIONAL COMPUTER CO., BETHESDA, MD.
VTS processing display subsystem design [AD-A074053] N80-15830
ISRAEL INST. OF TECH., HAIFA.
Studies of non-linear aerodynamic characteristics of flared slender bodies at high angles of attack [TAE-349] N80-15032
Influence of geometric and kinematic factors on combustion performance [TAE-350] N80-15214
The effect of initial twist on the torsional rigidity of beams: Another point of view [TAE-360] N80-15427
Semi-analytical formulae for real-time implementation of optimal missile avoidance strategies [TAE-352] N80-15834
ITT DEFENSE COMMUNICATIONS DIV., NUTLEY, N.J.
Phased array antenna amplifier exploratory development model [AD-A074961] N80-15315

J

JAYCOR, ALEXANDRIA, VA.
Continued development of fluid dynamics models [AD-A073845] N80-15367
JET PROPULSION LAB., CALIFORNIA INST. OF TECH., PASADENA.
Geologic application of thermal inertia imaging using HCMM data [ERO-10035] N80-15529
JOINT INST. FOR LAB. ASTROPHYSICS, BOULDER, COLO.
Lyman alpha initiated winds in late-type stars [NASA-CR-162467] N80-16008
JOINT TECHNICAL COORDINATING GROUP FOR AIRCRAFT SURVIVABILITY, WASHINGTON, D.C.
PRIME and PDQ sorts: Efficient minimal storage sorting algorithms [AD-A073567] N80-15841

K

KANNER [LEO] ASSOCIATES, REDWOOD CITY, CALIF.
Calculation of quadrupolar focusing of a linear accelerator and of beam adaptation in the presence of a space charge [LA-TR-79-15] N80-15901
KANSAS STATE UNIV., MANHATTAN.
A universal model for estimating wheat yields [CONTRIB-78-268-A] N80-15511
KENTUCKY UNIV., LEXINGTON.
Thermo-mechanical stress analysis of advanced turbine blade cooling configuration [AD-A074098] N80-15136

L

LAMONT-DOHERTY GEOLOGICAL INST., PALISADES, N. Y.
Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] N80-15446
LIBRARY OF CONGRESS, WASHINGTON, D. C.
Study of message text formats: Bibliographic search queries [ISSN-0160-9742] N80-15981
LINCOLN LAB., MASS. INST. OF TECH., LEXINGTON.
Differential orbit correction for near-stationary artificial satellites [AD-A074231] N80-15196
Flywheel energy storage interface unit for photovoltaic applications [COO-4094-44] N80-15609
Flywheel energy storage and conversion system for photovoltaic applications [COO-4094-45] N80-15635
Description of the MIT/Lincoln Laboratory photovoltaic systems test facility [COO-4094-41] N80-15638
Restoration of speckle images [AD-A074626] N80-15920
Advanced electronic technology [AD-A074083] N80-15950
LITTLE [ARTHUR D.], INC., CAMBRIDGE, MASS.
Solar power satellite system definition study. Volume 1: Executive summary [NASA-CR-160442] N80-15195
Utilization of waste heat from Federal facilities [ORO-5523-T1] N80-15590
Factors related to the implementation and diffusion of new technologies: A pilot study [PB-299998/6] N80-15978
LOCKHEED-CALIFORNIA CO., BURBANK.
Hypersonic cruise aircraft propulsion integration study, volume 1 [NASA-CR-159926-VOL-1] N80-15074
Hypersonic cruise aircraft propulsion integration study, volume 2 [NASA-CR-159926-VOL-2] N80-15075
LOCKHEED ELECTRONICS CO., HOUSTON, TEX.
LACIE: area sampling frame and sample selection N80-15452
LACIE data-handling techniques N80-15463
The acquisition, storage, and dissemination of LANDSAT and other LACIE support data N80-15464
Cartography: LACIE's spatial processor N80-15474
Considerations for design of future research and development interactive image analysis systems N80-15478
On evaluating clustering procedures for use in classification N80-15494
CLASSY: An adaptive maximum likelihood clustering algorithm N80-15495
Methods of extending crop signatures from one area to another N80-15500
LACIE analyst interpretation keys N80-15505
Image and numerical display aids for manual interpretation N80-15508
A programmed labeling approach to image interpretation N80-15509
The law of the minimum and an application to wheat yield estimation N80-15512
LOCKHEED-GEORGIA CO., MARIETTA.
Exploratory studies of the cruise performance of upper surface blown configuration: Experimental program, high-speed force tests [NASA-CR-159134] N80-15070
Exploratory studies of the cruise performance of upper surface blown configurations: Experimental program, high-speed pressure tests [NASA-CR-159135] N80-15071
Exploratory studies of the cruise performance of upper surface blown configurations: Program analysis and conclusions [NASA-CR-159136] N80-15072
Comparison of international flutter requirements and flutter freedom substantiation of light aircraft in the USA N80-15142
LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CALIF.
Analysis of X-ray and EUV spectra of solar active regions [NASA-CR-161364] N80-16016
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Preparation of unidirectional fiber reinforced tantalum carbide composites [LA-UR-79-951] N80-15211
New heat transfer geometry for hydride heat engines and heat pumps [LA-7822] N80-15289
Method of optimal truncation: A new t-matrix approach to elastic wave scattering [LA-UR-79-1954] N80-15324
Overvoltage protection by point-plane spark gaps [LA-UR-79-1655] N80-15345
Prospects of using large vacuum photodiodes with gas scintillation proportional counters [LA-UR-79-1246] N80-15382
Investigation of efficiency optimization in free electron lasers [LA-UR-79-2176] N80-15400
Tunable lasers for waste management photochemistry applications [LA-7113-MS] N80-15402
Mirror quality required by the Antares laser system [LA-UR-79-2056] N80-15405
Extended likelihood inference in reliability [LA-7517-MS] N80-15426
Linear and nonlinear symmetrically loaded shells of revolution approximated with the finite element method [LA-7538-MS] N80-15439
Decentralized solar photovoltaic energy systems [LA-7866-TASE] N80-15565
Water use alternatives for Navajo energy production [LA-UR-79-1598] N80-15643
Finite element method for studying the transient nonlinear thermal creep of geological structures [LA-7883-MS] N80-15718
Northwest New Mexico boundary layer experiment [LA-7525-MS] N80-15751
Mental dynamics [LA-7946-MS] N80-15820
General least-squares fitting procedures to minimize the volume of a hyperellipsoid [LA-UR-79-2330] N80-15855
SNEX: Semianalytic solution of the one-dimensional discrete ordinates [S/a] transport equations with diamond differenced angular fluxes [LA-7879-MS] N80-15856
Methods for numerical conformal mapping [LA-7836-MS] N80-15857
Quantitative comparison of multiple-photon absorption in polyatomic molecules [CONF-790690-3] N80-15892
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program [LA-7980-PR] N80-15902
Relativistic electron beam propagation: Two-stream theory [LA-7912-MS] N80-15905
Shallow land burial: Experience and developments at Oak Ridge and Los Alamos [LA-UR-79-1039] N80-15912
Parametric study of the Tormac fusion reactor concept [LA-7935-MS] N80-15931
Global properties of ohmically heated reversed-field pinches [LA-UR-79-2344] N80-15934
Physical conditions in reversed field pinches and theta pinches as inferred from simulations [LA-UR-79-2366] N80-15937
Statistical theory of Langmuir turbulence [LA-UR-79-576] N80-15940
Two-stream instability for a scattered beam propagating in a collisional plasma [LA-UR-79-1687] N80-15945
Hydrogen scattering cross section, 1H[n,n]1H [LA-7899-MS] N80-15958
Common file system reference manual, PIM-5 [LA-5525-M-VOL-5] N80-15988
Imaging X-ray spectrometer to study solar activity in conjunction with the SCADM program [LA-UR-79-1921] N80-16019
LOUISIANA STATE UNIV. AND A&M COLL., BATON ROUGE.
Evaluation of the vane shear test in Louisiana [PB-299872/3] N80-15723

M

MAGNAVOX GOVERNMENT AND INDUSTRIAL ELECTRONICS CO., TORRANCE, CALIF.
Design study of a low cost civil aviation GPS receiver system [NASA-CR-159176] N80-15062
MARTIN MARIETTA LABS., BALTIMORE, MD.
Separation jump and sudden stall over an ellipsoidal wind at incidence [AD-A074260] N80-15054
MARYLAND UNIV., COLLEGE PARK.
Data model processing: An approach to standardization of database management systems [AD-A074601] N80-15827
The FLEX system: User and caretaker's manual [AD-A073997] N80-15844
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Theory of chemical kinetics [COO-2873-3] N80-15223
Directional solidification at ultra-high thermal gradient [NASA-CR-159797] N80-15300
Analytical models and experimental studies of centrifugal-pump performances in two-phase flow [EPRI-NP-677] N80-15415
Analytical diffusion model for long distance transport of air pollutants [PB-299356/2] N80-15675
Teleoperators under the sea [PB-299483/9] N80-15824
Analysis techniques for multivariate root loci [NASA-CR-162570] N80-15853
Deformed shapes of hadrons [COO-3069-T1] N80-15882
Bifurcation and stability in Yang-Mills theory with sources [COO-3069-655] N80-15971
Linear multiple objective problems with interval coefficients [AD-A073967] N80-15975

Scheduling of flexible flowshops [systems aspects of flexible manufacturing systems]
[PB-301218/4] N80-15979
Crystallization, flow and thermal histories of lunar and terrestrial compositions
[NASA-CR-162465] N80-16013
MASSACHUSETTS UNIV., AMHERST.
Mitigating effects in the plastic failure of shells subjected to axially dependent dynamic pressure loadings
[COO-4122-27] N80-15683
MATHTECH, INC., PRINCETON, N. J.
Evaluation of the environmental effects of western surface coal mining, volume 1
[PB-300375/3] N80-15681
MATRA SERVICE AERODYNAMIQUE, VELIZY-VILLACOUBLAY [FRANCE].
Aerodynamic study of missile control surfaces
N80-15177
MCDONNELL AIRCRAFT CO., ST. LOUIS, MO.
Correlation of F-15 flight and wind tunnel test control effectiveness
N80-15152
Control integration technology impact
N80-15162
MCDONNELL-DOUGLAS RESEARCH LABS., ST. LOUIS, MO.
Advanced methods for preparation and characterization of infrared detector materials
[NASA-CR-161352] N80-15948
MCELROY [RALPH] CO., AUSTIN, TEX.
Particle dynamics in ion linear accelerator operating in double frequency regime
[LA-TR-79-19] N80-15900
MECHANICAL TECHNOLOGY, INC., LATHAM, N. Y.
Free-piston Stirling engine demonstration test plan
[COO-2764-T3] N80-15567
MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., HAMBURG [WEST GERMANY].
Some investigations concerning the effects of gaps and vortex generators on elevator efficiency and of landing flap sweep on aerodynamic characteristics
N80-15178
MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., MUNICH [WEST GERMANY].
Wind tunnel investigation of controls for DF on a fighter-type configuration of higher angles of attack
N80-15166
METEOROLOGY RESEARCH, INC., ALTADENA, CALIF.
Changes in cloud base precipitation particle size-distributions as a response variable to seeding
[PB-299549/4] N80-15761
MIAMI UNIV., FLA.
Numerical modeling of baroclinic instability
[NASA-CR-161363] N80-15706
MICHIGAN UNIV., ANN ARBOR.
Acid rain: Mesoscale model
N80-15655
Acid rain: Microphysical model
N80-15656
Analysis of the early phase of Tokamak plasma ohmic heating
[WFPS-TME-79-018] N80-15927
MICROWAVE ASSOCIATES, INC., BURLINGTON, MASS.
Ka-band microwave integrated circuit SPDT switch development
[AD-A074602] N80-15335
MIDWEST RESEARCH INST., GOLDEN, COLO.
SERAPH implementation plans
[SERI/RR-34-152] N80-15570
Alternate cycles applied to ocean thermal energy conversion
[SERI/TP-34-185] N80-15571
Application of Monte Carlo techniques to insolation characterization and prediction
[SERI/RR-36-306] N80-15579
Low temperature thermal energy storage: A state-of-the-art survey
[SERI/RR-54-164] N80-15583
Role of the government in the development of solar energy
[SERI/TP-52-138] N80-15639
MILITARY ACADEMY, WEST POINT, N. Y.
Interactive graphic techniques for conceptual engineering design
[AD-A073837] N80-15840
MINISTERO DELL'AGRICOLTURA E DELLE FORESTE, ROME [ITALY].
Topographical characteristics through the study of the thermal and hydrological dissimilarity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
[E80-10020] N80-15447
MINNESOTA UNIV., MINNEAPOLIS.
Melting in phase-change thermal storage media
[COO-2993-1] N80-15584
Quantum mechanics with applications to quarkonium
[COO-1764-360] N80-15970
MISSION RESEARCH CORP., LA JOLLA, CALIF.
Neutron hardness assurance guidelines for semiconductor devices
[AD-A074882] N80-15951
MISSISSIPPI UNIV., UNIVERSITY.
Storm research
[PB-300299/5] N80-15760
MISSOURI UNIV. -ROLLA.
Response of nonlinear structural panels subjected to high intensity noise
[AD-A076966] N80-15432
MISSOURI UNIV. -ST. LOUIS.
Potential laser action in the He-metal vapor mixtures
[AD-A074594] N80-15393
MITRE CORP., HOUSTON, TEX.
Cost and performance characteristics of data system configurations for processing remotely sensed data
N80-15481
MONSANTO CO., ALVIN, TEX.
The Beryllium-7 program of the Houston area outdoors study
[PB-299632/0] N80-15678
MONTEFIORE HOSPITAL, NEW YORK.
Sleep stage organization: Neuro endocrine relations
N80-15809
Biological rhythms of man living in isolation from time cues
N80-15813
MOUND LAB., MIAMISBURG, OHIO.
Utility and math subroutines for the M6800 microprocessor
[MLM-2564] N80-15947
MUNICIPAL ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OHIO.
Progress in wastewater disinfection technology
[PB-299338/4] N80-16001

N

NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL, WASHINGTON, D. C.
An evaluation of activated carbon for drinking water treatment
[PB-299968/5] N80-15228
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS. AMES AERONAUTICAL LAB., MOFFETT FIELD, CALIF.
Applications of modern hydrodynamics to aeronautics. Part 1: Fundamental concepts and the most important theorems. Part 2: Applications
[NACA-116] N80-15034
The mechanism of fluid resistance
N80-15035
Pressure distribution on Joukowski wings
[NACA-TM-336] N80-15036
Graphic construction of Joukowski wings
[NACA-TM-336] N80-15037
The minimum induced drag of aerofoils
[NACA-121] N80-15038
The aerodynamic forces on airship hulls
[NACA-184] N80-15039
Elements of the wing section theory and of the wing theory
[NACA-191] N80-15040
Remarks on the pressure distribution over the surface of an ellipsoid, moving translationally through a perfect fluid
[NACA-TM-196] N80-15041
The inertia coefficients of an airship in a frictionless fluid
[NACA-164] N80-15042
Flow and drag formulas for simple quadrics
[NACA-253] N80-15043
Behavior of vortex systems
N80-15045
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS. LANGLEY AERONAUTICAL LAB., LANGLEY FIELD, VA.
General potential theory of arbitrary wing sections
[NACA-452] N80-15046
General theory of aerodynamic instability and the mechanism of flutter
[NACA-496] N80-15047
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D. C.
Aeronautical engineering. A continuing bibliography, supplement 115
[NASA-SP-7037[115]] N80-15027
NASA technical advances in aircraft occupant safety
[NASA-TM-80851] N80-15060
Value of crops: Quantity, quality and cost price
[NASA-TM-75925] N80-15537
The reaction of the atmosphere to solar disturbances
[NASA-TM-75500] N80-15704
Influence of hypokinesis on physiological functions in fowl
[NASA-TM-75999] N80-15778
The course of experimental staphylococcus infection in albino mice during action of certain factors of space flight
[NASA-TM-75973] N80-15779
Evoked potentials in immobilized cats to a combination of clicks with painful electrocutaneous stimuli
[NASA-TM-75941] N80-15780
Activity of cholinesterases of blood and heart in rats of different sex and age during muscular loads and hypokinesia
[NASA-TM-75951] N80-15781
Rat reaction to hypokinesia after prior adaptation to hypoxia
[NASA-TM-75964] N80-15782
Study on the neuronal circuits implicated in postural tremor and hypokinesia
[NASA-TM-76004] N80-15783
Aerospace medicine and biology: A continuing bibliography, supplement 200
[NASA-SP-7011[200]] N80-15787
Joint Soviet-American experiment on hypokinesia: Experimental results
[NASA-TM-76013] N80-15796
Results of medical studies during long-term manned flights on the orbital Salyut-6 and Soyuz complex
[NASA-TM-76014] N80-15797
Changes of some blood indices and myocardial electrolyte content during hypokinesia
[NASA-TM-75954] N80-15798
Mechanism of disorder of plastic processes in tissue during prolonged hypokinesia
[NASA-TM-75955] N80-15799
Model task for the dynamics of an underwater two-legged walker
[NASA-TM-75697] N80-15822
Problems in processing multiaxial video information at specialized computers
[NASA-TM-75919] N80-15837
Decision making and problem solving with computer assistance
[NASA-TM-76008] N80-15973
Research and Technology Objectives and Plans Summary [RTOPS]. Research and Technology program, fiscal year 1980
[NASA-TM-80744] N80-15974
NASA publications
[NASA-TM-80852] N80-15980
Reports of planetary geology program, 1979 - 1980
[NASA-TM-81776] N80-16010
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.
Classical aerodynamic theory
[NASA-RP-1050] N80-15033
NASA/Army XV-15 tilt rotor research aircraft wind-tunnel test program plan
[NASA-TM-78562] N80-15067
The effects of motion and g-seat cues on pilot simulator performance of three piloting tasks
[NASA-TP-1601] N80-15069
Evaluation of approximate methods for the prediction of noise shielding by airframe components
[NASA-TP-1004] N80-15129
Effects of primary rotor parameters on flapping dynamics
[NASA-TP-1431] N80-15138
Control of forebody three-dimensional flow separations
N80-15164
Stratospheric aerosol modification by supersonic transport operations with climate implications
[NASA-RP-1056] N80-15726
Some human factors issues in the development and evaluation of cockpit alerting and warning systems
[NASA-RP-1055] N80-15821
Studies in astronomical time series analysis: Modeling random processes in the time domain
[NASA-TM-81148] N80-15854
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. HUGH L. DRYDEN FLIGHT RESEARCH CENTER, EDWARDS, CALIF.
Landing approach airframe noise measurements and analysis
[NASA-TP-1602] N80-15028
Landing tests of a wing structure for a hypersonic aircraft
[NASA-TP-1596] N80-15068
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. EARTH RESOURCES LABS., BAY ST. LOUIS, MISS.
Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data
[NASA-TP-1553] N80-15535
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
LACIE registration processing
N80-15456
Acquisition and preprocessing of LANDSAT data
N80-15461
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.
Simple computations for near-optimum ascent and abort maneuver targets and deorbit ignition time
[NASA-TM-80850] N80-15185
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] N80-15448
Sampling, aggregation, and variance estimation for area, yield, and production in LACIE
N80-15449
LACIE sampling design
N80-15451
LACIE large area acreage estimation
N80-15453
Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts
N80-15454

Classification and mensuration of LACIE segments
N80-15455

Growth stage estimation
N80-15458

Accuracy assessment: The statistical approach to performance evaluation in LACIE
N80-15459

Ancillary data acquisition for LACIE
N80-15462

The classification and mensuration subsystem
N80-15465

Concepts leading to the IMAGE-100 hybrid interactive system
N80-15466

The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports
N80-15469

LACIE status and tracking
N80-15470

LACIE quality assurance
N80-15471

Accuracy assessment system and operation
N80-15472

LACIE applications evaluation system efficiency report
N80-15473

Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks
N80-15479

The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE
N80-15482

Application of LANDSAT digital data for monitoring drought
N80-15483

LACIE area, yield, and production estimate characteristics: U.S. Great Plains
N80-15484

LACIE area, yield, and production estimate characteristics: Canada
N80-15486

Accuracy and performance of LACIE area estimates
N80-15487

Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world
N80-15488

Accuracy and performance of LACIE crop development models
N80-15489

Methods for segment wheat area estimation
N80-15491

Estimating crop proportions from remotely sensed data
N80-15492

An evaluation of procedure 1
N80-15502

Colorimetric consideration of transparencies for a typical LACIE scene
N80-15506

Generation of uniform chromaticity scale imagery from LANDSAT data
N80-15507

Status of yield estimation technology: A review of second-generation model development and evaluation
N80-15510

Prediction of wheat phenological development: A state-of-the-art review
N80-15514

New developments in sampling and aggregation for remotely sensed surveys
N80-15515

Natural sampling strategy
N80-15516

Weighted aggregation
N80-15518

Design, implementation, and results of LACIE field research
N80-15519

The application test system: An approach to technology transfer
N80-15520

Proceedings of Shuttle Environmental Effects Program Review
[NASA-CP-2110] N80-15649

The physiological basis for spacecraft environmental limits
[NASA-RP-1045] N80-15788

Atmosphere
N80-15789

Thermal environment
N80-15791

Physical forces generating acceleration, vibration, and impact
N80-15792

Sound and noise
N80-15793

Radiofrequency radiation
N80-15794

Handbook of lunar materials
[NASA-RP-1057] N80-16009

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. JOHN F. KENNEDY SPACE CENTER, COCOA BEACH, FLA.

LOX/GOX mechanical impact tester assessment
[NASA-TM-74106] N80-15179

Air quality monitor and acid rain networks
N80-15650

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, HAMPTON, VA.

Computer program to prepare airfoil characteristic data for use in helicopter performance calculations
[NASA-TM-79627] N80-15031

A parametric wing design study for a modern laminar flow wing
[NASA-TM-80194] N80-15050

Control considerations for CCV fighters at high angles of attack
N80-15140

Stress-intensity factors and crack-opening displacements for round compact specimens
[NASA-TM-80174] N80-15430

Cloud volume studies
N80-15650

In situ exhaust cloud measurements
N80-15651

Measurement of particulates
N80-15652

A study of partial coherence for identifying interior noise sources and paths on general aviation aircraft
[NASA-TM-80197] N80-15874

A summary and evaluation of semi-empirical methods for the prediction of helicopter rotor noise
[NASA-TM-80200] N80-15875

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.

Summary of advanced methods for predicting high speed propeller performance
[NASA-TM-81409] N80-15051

Simultaneous cabin and ambient ozone measurements on two Boeing 747 airplanes, volume 1
[NASA-TM-79166] N80-15059

Quiet powered-lift propulsion
[NASA-CP-2077] N80-15127

Direct integration of transient rotor dynamics
[NASA-TP-1597] N80-15128

Computer simulation of engine systems
[NASA-TM-79290] N80-15132

Impact of new instrumentation on advanced turbine research
[NASA-TM-79301] N80-15133

An analytical and experimental study of a short v-shaped subsonic diffuser of a supersonic inlet
[NASA-TM-81408] N80-15134

Configuration effects on satellite charging response
[NASA-TM-81397] N80-15200

Analysis of GaAs and Si solar cell arrays for earth orbital and orbit transfer missions
[NASA-TM-81383] N80-15204

Adhesion and friction of iron-base binary alloys in contact with silicon carbide in vacuum
[NASA-TP-1604] N80-15234

Effect of sodium, potassium, magnesium, calcium, and chlorine on the high temperature corrosion of IN-100, U-700, IN-792, and Mar M-509
[NASA-TM-79309] N80-15235

Computer program for generating input for analysis of impingement-cooled, axial-flow turbine blade
[NASA-TP-1603] N80-15361

Computation of three-dimensional flow in turbofan mixers and comparison with experimental data
[NASA-TM-81410] N80-15364

Numerical simulation of supersonic inlets using a three-dimensional viscous flow analysis
[NASA-TM-81411] N80-15365

Comparison of predicted and experimental performance of large-bore roller bearing operating to 3.0 million DN
[NASA-TP-1599] N80-15410

Photovoltaic power system reliability considerations
[NASA-TM-79291] N80-15422

A relation between semiempirical fracture analyses and R-curves
[NASA-TP-1600] N80-15428

Possible methods for distinguishing icebergs from ships by aerial remote sensing
[NASA-TM-79310] N80-15538

Space solar cells: High efficiency and radiation damage
[NASA-TM-81387] N80-15554

Open-circuit voltage improvements in low resistivity solar cells
[NASA-TM-81388] N80-15555

Black surface reflectors for solar cells
[NASA-TM-81390] N80-15556

Radiation damage in lithium-counterdoped n/p silicon solar cells
[NASA-TM-81391] N80-15557

Radiation damage annealing mechanisms and possible low temperature annealing in silicon solar cells
[NASA-TM-81392] N80-15558

Candidate thermal energy storage technologies for solar industrial process heat applications
[NASA-TM-81390] N80-15560

Global calibration of terrestrial reference cells and errors involved in using different irradiance monitoring techniques
[NASA-TM-81393] N80-15561

Comparison of inlet suppressor data with approximate theory based on cutoff ratio
[NASA-TM-81386] N80-15876

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.

Baroclinic instability with variable gravity: A perturbation analysis
[NASA-TP-1586] N80-15445

Characterization of three types of silicon solar cells for SEPS deep space missions. Volume 1: Current-voltage characteristics of OCLI BSF/BSR 10 ohm-cm, and BSR 2 ohm-cm cells as a function of temperature and intensity
[NASA-TM-78253] N80-15562

Ground-based measurements of DM-2 rocket exhaust effluents using fixed-flow samplers and electrets
N80-15654

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Dobson spectrophotometer ozone measurements during international ozone rocketsonde intercomparison
[NASA-TM-73284] N80-15727

NATIONAL BUREAU OF STANDARDS, BOULDER, COLO.

Isobutane: Provisional thermodynamic functions from 114 to 700 K at pressures to 700 bar
[PB-299361/6] N80-15295

Evaluation of hand-held infrared thermometers for wall thermal resistance determinations
[PB-298057/1] N80-15367

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D.C.

Nitrogen-strengthened austenitic stainless steel for cryogenic magnet structures
[CONF-790815-13] N80-15258

Measurements and standards for recycled oil - 2
[PB-299951/4] N80-15275

Semiconductor Measurement Technology: NBS/DOE Workshop, Stability of [Thin Film] Solar Cells and Materials
[PB-299764/7] N80-15644

Measurement techniques for solar cells
[PB-301309/1] N80-15646

Chemical Kinetic Data Needs for Modeling the Lower Troposphere
[PB-299439/0] N80-15722

Computer science and technology: Computer Performance Evaluation Users Group [CPEUG], 15th
[PB-300668/4] N80-15833

International activities: The fiscal year 1978 survey of international programs at NEL
[PB-300491/6] N80-16004

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Summer fellowship in scientific computing
[PB-301297/8] N80-15724

Daily high-latitude 150 mb pressure maps from Twerle [Tropical Wind, reference level and energy conversion experiment] and rawinsondes. Part 1: 16 November 1975 - 31 January 1976
[PB-301343/0] N80-15766

Field observations of kinematics of hailstones
[PB-301387/7] N80-15767

Techniques employed in the processing of particle size spectra and state parameter data obtained with the T-28 aircraft platform
[PB-299362/4] N80-15771

MIE scattering calculations, advances in technique and fast, vector-shaped computer codes
[PB-301388/5] N80-15923

NATIONAL CENTER FOR RESOURCE RECOVERY, WASHINGTON, D. C.

Technical barriers to the reuse of aluminum recovered from municipal refuse
[PB-300436/3] N80-15261

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Input data for solar systems
[DOE/TIC-10193] N80-15580

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Error characteristics of satellite-derived winds
[PB-300754/9] N80-15759

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[PB-299694/0] N80-16021

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Surface circulation in the northwestern Gulf of Mexico as deduced from drift bottles
[PB-299078/6] N80-15776

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Test equipment for use in determining classifications of combustible dusts
[PB-300615/2] N80-15231

NATIONAL OCEAN SURVEY, ROCKVILLE, MD.

Performance evaluations of the orbisphere laboratories models 2702 and 2709 oxygen measuring systems
[PB-300721/8] N80-15386

Technical papers on airborne laser hydrography
[PB-299321/0] N80-15546
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[PB-299878/9] N80-15756
System considerations of a long range coherent lidar wind sensor with particular emphasis on real weather effects
[PB-299972/0] N80-15757
Meteorological effects of oil refinery operations in Los Angeles
[PB-300720/0] N80-15758
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, COLUMBIA, MO.
CCEA second-generation wheat yield model for hard red wheat in North Dakota
N80-15513
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, HOUSTON, TEX.
Operation of the yield estimation subsystem
N80-15468
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FLA.
Survey of satellite sensors and data with application to OTEC resource and operations requirements
[PB-300297/9] N80-15543
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, WASHINGTON, D. C.
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[PB-301263/5] N80-15765
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[AD-A074885] N80-16022
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[PB-300865/3] N80-15755
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[NTIS/PS-79/0984/9] N80-15260
High temperature lubricants and oils, volume 2. Citations from the Engineering Index data base
[NTIS/PS-79/1032/6] N80-15274
Antenna sidelobe and interference reduction. A bibliography with abstracts
[NTIS/PS-79/1013/6] N80-15325
Light communication systems, volume 3. A bibliography with abstracts
[NTIS/PS-79/0994/9] N80-15327
Atmospheric effects on laser beams, volume 2. A bibliography with abstracts
[NTIS/PS-79/0981/5] N80-15409
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[NTIS/PS-79/1028/4] N80-15418
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[NTIS/PS-79/0973/2] N80-15671
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[NTIS/PS-79/0989/8] N80-15721
Clear air turbulence. A bibliography with abstracts
[NTIS/PS-79/0972/4] N80-15752
Minicomputers, volume 2. A bibliography with abstracts
[NTIS/PS-79/0978/1] N80-15832
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[NTIS/PS-79/0979/9] N80-15850
Fiber optics, volume 3. A bibliography with abstracts
[NTIS/PS-79/1006/0] N80-15924
Management by objectives. A bibliography with abstracts
[NTIS/PS-79/0958/3] N80-15976
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[NTIS/PS-79/0971/6] N80-15990
NATIONAL WEATHER SERVICE, HONOLULU, HAWAII.
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[PB-300790/3] N80-15754
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[PB-298900/2] N80-15762
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[PB-300870/3] N80-15753
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[PB-300715/0] N80-15764
NATURAL DYNAMICS, DES MOINES, IOWA.
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[COO-2900-17-VOL-2] N80-15283
NAVAL AIR DEVELOPMENT CENTER, WARMINSTER, PA.
Visual accomodation responses in a virtual image environment
[AD-A074415] N80-15082
NAVAL AIR TEST CENTER, PATUXENT RIVER, MD.
JA-6A circulation control wing contractor flight demonstration
[AD-A074888] N80-15080
NAVAL ENVIRONMENTAL PREDICTION RESEARCH FACILITY, MONTEREY, CALIF.
Modeling the refractive index structure parameter in the marine planetary boundary layer
[AD-A074275] N80-15710
A preliminary analysis of mesoscale effects of topography on tropical cyclone-associated surface winds
[AD-A074812] N80-15733
NAVAL HEALTH RESEARCH CENTER, SAN DIEGO, CALIF.
Sleep disturbances in humans
N80-15810
Sleep disturbance and performance
N80-15814
NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CALIF.
Spectral, far-field, and near-field measurements of five light-emitting diodes
[AD-A074517] N80-15339
NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.
A conceptual design of a lighter-than-air test and research vehicle
[AD-A074760] N80-15053
High-strength aluminum-magnesium alloys: Thermomechanical processing, microstructure and tensile mechanical properties
[AD-A074185] N80-15238
Design of the digital control and test unit subsystems for a satellite signal analyzer
[AD-A073928] N80-15313
Narrowband voice system
[AD-A074445] N80-15314
Geometric design technique for two-dimensional analog and digital filters
[AD-A073963] N80-15334
An in-depth study of the sensitivity of wave digital filters
[AD-A073962] N80-15338
A simple model for calculating the index of refraction of neon I and neon [3S] in the cavity of a xenon fluoride laser
[AD-A074380] N80-15392
Stimulated emission by relativistic electrons traversing a periodic magnetic field
[AD-A073888] N80-15396
Refinement of a statistical diagnostic model of marine fog using FNWC model output parameters
[AD-A073959] N80-15730
Distributed, secure design for a multi-microprocessor operating system
[AD-A073923] N80-15828
The design and implementation of an inexpensive microprocessor development system for the Z-80 microprocessor
[AD-A073927] N80-15829
NAVAL RESEARCH LAB., WASHINGTON, D. C.
Analytic analysis of linear growth rates of gyrotron for TEins mode with zero-temperature beam electrons
[AD-A074368] N80-15397
A global ionospheric model
[AD-A074370] N80-15709
Development of imploding liner systems for the NRL LINUS program
[AD-A075005] N80-15926
Solar flare spectroscopic diagnostics for wavelengths less than 2000 angstroms
[AD-A070569] N80-16018
NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, BETHESDA, MD.
Analytical solutions for open nonshallow spherical shell vibrations
[AD-A074269] N80-15434
NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, WASHINGTON, D. C.
Flow and force equations for a body revolving in a fluid
[NACA-323] N80-15044
NAVAL SURFACE WEAPONS CENTER, DAHLGREN, VA.
Perturbations in perigee and eccentricity at the critical inclination
[AD-A073975] N80-15192
Comparison of C-band radar and Doppler geoceiver accuracies in orbit determination
[AD-A073877] N80-15193
NAVAL SURFACE WEAPONS CENTER, WHITE OAK, MD.
Moisture sorption and diffusion in Kevlar 49 aramid fiber
[AD-A074547] N80-15266
NAVAL UNDERWATER SYSTEMS CENTER, NEW LONDON, CONN.
Performance and timeliness in a database
[AD-A074552] N80-15826
NAVAL WEAPONS CENTER, CHINA LAKE, CALIF.
Synthesis of spread spectrum signals from the nonbinary Galois field
[AD-A074604] N80-15312
Ice nuclei measurements from solid rocket motor effluents
N80-15653
NAVAL WEATHER SERVICE DETACHMENT, ASHEVILLE, N. C.
Summary of Synoptic Meteorological Observations [SSMO]. Selected South Pacific island marine areas, volume 2. Area 9: Isle Wallis. Area 10: Samoa Islands. Area 11: New Caledonia. Area 12: New Hebrides Islands. Area 13: Fiji Islands. Area 14: Tonga Islands. Area 15: Niue Island. Area 16: Rarotonga Island [lower Cook Islands]
[AD-A073446] N80-15745
Summary of Synoptic Meteorological Observations [SSMO]. Selected South Pacific island marine areas, volume 1. Area 1: Nauru Island and Ocean Island. Area 2: Gilbert Islands. Area 3: Canton and Phoenix Islands. Area 4: Christmas and Jarvis Islands. Area 5: Solomon Islands, Northeast. Area 6: Solomon Islands, Southwest. Area 7: Funafuti Atoll. Area 8: Marquesas Islands
[AD-A073445] N80-15746
NIELSEN ENGINEERING AND RESEARCH, INC., MOUNTAIN VIEW, CALIF.
Nonlinear aerodynamics of all-movable controls
N80-15173
NEW BRUNSWICK ELECTRIC POWER COMMISSION, FREDERICTON.
Measurement of energy to heat houses: Initial study
[PB-299448/2] N80-15304
NEW MEXICO ENERGY INST., LAS CRUCES.
Economic analysis of small scale bioconversion units in New Mexico
[PB-301390/1] N80-15298
Use of geothermal energy for desalination in New Mexico: A feasibility study
[PB-299271/7] N80-15645
NEW MEXICO STATE UNIV., UNIVERSITY PARK.
District space heating potential of low temperature hydrothermal geothermal resources in the southwestern United States
[NMEI-10-1] N80-15582
NEW MEXICO UNIV., ALBUQUERQUE.
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[NTIS/PS-79/1018/5] N80-15326
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[NASA-CR-3222] N80-15048
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[NASA-CR-3223] N80-15049
NORTH CAROLINA UNIV. AT CHAPEL HILL.
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[PB-300947/9] N80-15991
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[PB-299934/0] N80-15552
NORTH TEXAS STATE UNIV., DENTON.
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[AD-A073920] N80-15952
NORTHROP CORP., HAWTHORNE, CALIF.
Forebody vortex blowing: A novel control concept to enhance departure/spin recovery characteristics of fighter and trainer aircraft
N80-15172
NORTHROP CORP., LOS ANGELES, CALIF.
Flaperon control: The versatile surface for fighter aircraft
N80-15158
NORTHWESTERN UNIV., EVANSTON, ILL.
Dynamics of composite materials and elastic structural elements with variable dimensions
[AD-A074592] N80-15206
Studies of metal-semiconductor interfaces in catalysis and energy conversion
[COO-4946-1] N80-15221
Anomalies in X-ray residual stress measurements in cold-rolled steels
[AD-A074802] N80-15239
Effect of point defects on mechanical properties of metals
[COO-1367-97] N80-15245
NUCLEAR REGULATORY COMMISSION, WASHINGTON, D. C.
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[NUREG-CR-0782] N80-15376

O

O'DONNELL AND ASSOCIATES, INC., PITTSBURGH, PA.
More efficient creep ratcheting bounds
[ORNL/SUB-7222/1] N80-15441
OAK RIDGE ASSOCIATED UNIVERSITIES, TENN.
Development of the Rocky Mountain Energy and Environmental Technology Center: A preliminary analysis
[ORAU-159] N80-15670
OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
Modifying the GNATS mesh generation code to improve the modeling of branched structures
[K/CSD/TM-26] N80-15444
OAK RIDGE NATIONAL LAB., TENN.
Single-stage mass spectrometric analyses of resin bead samples
[ORNL/TM-6563] N80-15224
Mass and emissions spectrometry in the Analytical Chemistry Division of Oak Ridge National Laboratory
[ORNL/TM-6485] N80-15226
Progress in calculations of the superconducting properties of transition metals
[CONF-790653-4] N80-15242
Fatigue crack propagation in 21/4 Cr-1 Mo steel
[CONF-790802-41] N80-15250
Corrosion of several alloys in superheated steam at 482 and 538 deg centigrade
[ORNL/TM-6465] N80-15252
Propagation of normal zones in thermally insulated superconductors
[CONF-790815-16] N80-15351
Electric characteristics of ion-implanted laser-annealed silicon
[CONF-780932-4] N80-15352
Computation of transient 3-D eddy current in nonmagnetic conductor
[CONF-780939-1] N80-15356
Analysis and computer programs for eddy current coils concentric with multiple cylindrical conductors
[ORNL-5220] N80-15359
Limitations of thermocouples in temperature measurements
[CONF-790505-16] N80-15387
Pulsed dye laser OAS with a Helmholtz resonator cell
[CONF-790819] N80-15404
Metallographic quality control of welding and brazing
[CONF-790730-1] N80-15425
Unified creep-plasticity model for structural metals at high temperature
[ORNL/TM-5969] N80-15440
Heat transfer studies in salt and granite
[ORNL/ENG/TM-14] N80-15581
Intermediate report on the performance of plate-type ice-maker heat pumps
[ORNL/CON-23] N80-15619
Characterization of operating conditions for gas/water heat recovery steam generators
[ORNL/TM-6622] N80-15620
Analysis of potential implementation levels for waste heat utilization in the nuclear power industry
[ORNL/TM-63-2] N80-15625
Regularity of solutions to an inhomogeneous differential equation in Banach space
[CONF-790610-1] N80-15862
Microcomputer-controlled ultrasonic data acquisition system
[ORNL/TM-6531] N80-15877
Electron impact ionization of multicharged ions
[ORNL/TM-7020] N80-15879
Fast numerical calculations of ion-atom collisions
[CONF-790511-1] N80-15880
Diagnostic neutral beams for spectroscopic studies of impurities by charge-transfer reactions
[CONF-790585-2] N80-15887
Compatibility of structural materials with fusion reactor coolant and breeder fluids
[CONF-790125-77] N80-15906
Materials experience with Tokamak plasmas
[CONF-790125-54] N80-15943
Itinerant electron magnetism in 3D-transition metals
[CONF-790738-1] N80-15959
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Dynamic identification of light aircraft structures and their flutter certification
N80-15145
Problems of unsteady aerodynamics raised by the use of control surfaces as active controls
N80-15167
Unsteady effects of a control surface in two dimensional, subsonic and transonic flow
N80-15168
Aerodynamic interaction on a close-coupled canard wing configuration
N80-15175
OHIO STATE UNIV., COLUMBUS.
Analysis of wire antennas mounted near or at the edge of a half-plane
[AD-A074450] N80-15310
Power optimization in adaptive array: A technique for interference protection
[AD-A074429] N80-15311
Fuel utilization in residences
[EPRI-EA-894] N80-15604
OHIO STATE UNIV. RESEARCH FOUNDATION, COLUMBUS.
On the multiple scattering of waves from obstacles with solid-fluid interfaces
[AD-A074057] N80-15433
OHIO UNIV., ATHENS.
Experimental loop antennas for 60 KHz to 200 KHz
[NASA-CR-162729] N80-15063
Data reduction software for LORAN-C flight test evaluation
[NASA-CR-162730] N80-15064
Loran digital phase-locked loop and RF front-end system error analysis
[NASA-CR-162751] N80-15065
OKLAHOMA STATE UNIV., STILLWATER.
Electronic structure of defects in oxides
[ORO-4837-4] N80-15967
OKLAHOMA UNIV., NORMAN.
Classical analyses of laminated bimodulus composite-material plates
[AD-A074125] N80-15208
Critical speeds and natural frequencies of rim-type composite-material flywheels
[SAND-78-7049] N80-15422
The crystal structure and variable temperature ^{119m}Sn Mossbauer study of trimethyltin glycinate, a one-dimensional, amino-bridged polymer
[AD-A074383] N80-15955
OLD DOMINION UNIV. RESEARCH FOUNDATION, NORFOLK, VA.
Control systems design for large flexible space structures
[NASA-CR-162582] N80-15201
Soil analyses and evaluations at the impact dynamics research facility for two full-scale aircraft crash tests
[NASA-CR-159199] N80-15299
OPERATIONS RESEARCH, INC., SILVER SPRING, MD.
Development of a quality assurance methodology for the technical information generation subsystem of NTIPS
[AD-A074299] N80-15984
OREGON STATE UNIV., CORVALLIS.
Investigation of the viability and cost effectiveness of solid fuel gasifiers close coupled to internal combustion engines for 200 kWe power generation
[DOE/RL/90476-13] N80-15293
Solar energy meteorological research and training site, region 5
[DOE/ET/20172-1] N80-15750

P

PARAGON PACIFIC, INC., EL SEGUNDO, CALIF.
Evaluation of feasibility of prestressed concrete for use in wind turbine blades
[NASA-CR-159725] N80-15553
PEDCO-ENVIRONMENTAL, INC., CINCINNATI, OHIO.
EPA utility FGD [Flue Gas Desulfurization] survey: December 1978 - January 1979
[PB-299299/6] N80-15682
PEDCO-ENVIRONMENTAL, INC., KANSAS CITY, MO.
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[PB-300443/9] N80-15702
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
Nuclear powered satellite studies
[COO-4045-4] N80-15198
Multiconfiguration Hartree-Fock method for atomic energy levels and transition probabilities
[COO-4264-3] N80-15884
PENNWALT CORP., KING OF PRUSSIA, PA.
Development of a special purpose spacecraft interior coating, phase 2
[NASA-CR-160441] N80-15199
PERCEPTRONICS, INC., WOODLAND HILLS, CALIF.
Man-machine communication in computer-aided remote manipulation
[AD-A074566] N80-15823
PHYSICAL DYNAMICS NORTHWEST, BELLEVUE, WASH.
An analysis of atmospheric visibility data in the Houston area
[PB-299633/8] N80-15680
PHYSICS INTERNATIONAL CO., SAN LEANDRO, CALIF.
Pulser for vertically polarized dipole facility [VPD-2]
[AD-A074838] N80-15319
Development of a high-voltage linear actuator amplifier system
[AD-A074266] N80-15343
PITTSBURGH UNIV., PA.
An investigation of the initiation stage of hot corrosion in Ni-base alloys
[NASA-CR-159718] N80-15233
Systolic priority queues
[AD-A074494] N80-15852
Estimation of variance components
[AD-A074223] N80-15967
Some features of Rayleigh scattering from light atoms and ions
[UCRL-15046] N80-15886
PLANNING RESEARCH CORP., MCLEAN, VA.
Inverted file facility: User's guide
[AD-A074081] N80-15982
POLYTECHNIC INST. OF NEW YORK.
A methodology for evaluating the effectiveness of transportation improvements for the elderly and handicapped
[PB-300440/5] N80-16007
PRINCETON UNIV., N. J.
Study of electronic transport and breakdown in thin insulating films
[AD-A074457] N80-15342
An analytic method for strong motion studies in layered media
[PB-301116/0] N80-15725
Fusion-supported decentralized nuclear energy system
[PPPL-1555] N80-15907
Theory of drift-wave eigenmodes in toroidal plasmas
[PPPL-1562] N80-15936
Iterative metric method for solving the inverse Tokamak equilibrium problem
[PPPL-1564] N80-15941
PROCESS PARTICULATE MONITORS, INC., KNOXVILLE, TENN.
Principles, calibration and process experience for a new laser aerosol detector system
[BNL-25014] N80-15403
PUERTO RICO SCIENTIFIC RESEARCH LAB., INC., RIO PIEDRAS.
Production of sugarcane and tropical grasses as a renewable energy source
[DOE/CS/5912-T1] N80-15277
PURDUE UNIV., LAFAYETTE, IND.
Sulfur fixation during coal gasification
[PB-301104/6] N80-15296
The effects of substrate composition on thick film circuit reliability
[AD-A074907] N80-15333

Q

Q&I, INC., BEDFORD, MASS.
Information management problems relating to numeric data base services for DOE
[DOE/TIC-10144] N80-15989
QUEEN MARY COLL., LONDON (ENGLAND).
Unsteady aerodynamics of two-dimensional spoilers at low speeds
N80-15170
On the effects of gaps on control surface characteristics
N80-15176

R

RADIAN CORP., AUSTIN, TEX.
Field and laboratory studies for the development of effluent standards for the steam electric power industry
[PB-299097/6] N80-15689
RAND AFRIKAANS UNIV., JOHANNESBURG (SOUTH AFRICA).
An experimental study of the instability of thrinor controlled systems
[RAU-E1-74-2-4] N80-15329
RAND CORP., SANTA MONICA, CALIF.
Nomograms for the calculation of propagation effects on tactical millimeter wave radio links
[AD-A073900] N80-15322
RAYTHEON CO., SUDBURY, MASS.
Care 3, Phase I, volume 1
[NASA-CR-159122] N80-15423
Care 3, phase 1, volume 2
[NASA-CR-159123] N80-15424
RENSSELAER POLYTECHNIC INST., TROY, N. Y.
Composite structural materials
[NASA-CR-162578] N80-15076
Uniaxial creep, cyclic creep and relaxation of AISI type 304 stainless steel at room temperature: An experimental study
[AD-A074958] N80-15240
A theory of thermoviscoplasticity for uniaxial mechanical and thermal loading
[AD-A074957] N80-15431
Comparison of diurnal fluctuations of dissolved inorganic carbon and algal productivity estimates in an oligotrophic and mesotrophic freshwater environment
[PB-301201/0] N80-15785
RESEARCH ADVISORY INST., INC., SOUTH LAGUNA, CALIF.
Superconducting microwave pulse amplifier
[AD-A074056] N80-15331
RESEARCH TRIANGLE INST., DURHAM, N. C.
Biological screening of complex samples from industrial/energy processes
[PB-300459/5] N80-15805

RESEARCH TRIANGLE INST., RESEARCH TRIANGLE PARK, N. C.
Study of the nature of ozone, oxides of nitrogen, and nonmethane hydrocarbons in Tulsa, Oklahoma. Volume 1: Project description and data summaries
[PB-300481/9] N80-15229
Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data
[ORO-5444-1] N80-15603
Captive air bag design study
[PB-299636/1] N80-15673
Houston area oxidant study detailed hydrocarbon analyses
[PB-299629/5] N80-15674
RHODE ISLAND UNIV., KINGSTON.
Extremely high latitude auroras, part 1
[AD-A074989] N80-15711
RICE CENTER FOR COMMUNITY DESIGN AND RESEARCH, HOUSTON, TEX.
Socio-economic impact analysis of selected air pollution controls in the Houston-Galveston region
[PB-299635/3] N80-15679
RICE UNIV., HOUSTON, TEX.
Birkeland currents and ring currents in the computer simulation of the substorm of 19 September 1976
[AD-A073852] N80-15712
ROCKETDYNE, CANOGA PARK, CALIF.
Liquid oxygen/liquid hydrogen auxiliary power system thruster investigation
[NASA-CR-159674] N80-15202
ROCKWELL INTERNATIONAL CORP., EL SEGUNDO, CALIF.
Analyses and tests of the B-1 aircraft structural mode control system
[NASA-CR-144887] N80-15073
ROCKWELL INTERNATIONAL SCIENCE CENTER, THOUSAND OAKS, CALIF.
Treatment of Am 355 steel for adhesive bonding
[AD-A074113] N80-15230
ROME AIR DEVELOPMENT CENTER, GRIFFISS AFB, N.Y.
VLF/LF reflectivity of the polar ionosphere, 23 April - 2 September 1978
[AD-A074762] N80-15318
Two-pole varactor-tuned helical resonator filters
[AD-A074476] N80-15332
ROME UNIV. [ITALY].
Trajectory behaviour of a control configurated aircraft subjected to random disturbances N80-15171
ROYAL AIR FORCE INST. OF AVIATION MEDICINE, FARNBOROUGH [ENGLAND].
Hypnotics and the management of disturbed sleep N80-15818
ROYAL AIRCRAFT ESTABLISHMENT, BEDFORD [ENGLAND].
Aerodynamic characteristics of moving trailing-edge controls at subsonic and transonic speeds N80-15169
ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH [ENGLAND].
A flutter-speed formula for wings of high aspect ratio N80-15147
A survey of experimental data on the aerodynamics of controls, in the light of future needs N80-15151
Some wind tunnel measurements of the effectiveness at low speeds of combined lift and roll controls N80-15153
RUHR UNIV., BOCHUM [WEST GERMANY].
On the effect of wing wake on tail characteristics N80-15174

S

SAN JOSE STATE UNIV., CALIF.
Survey of statistical techniques used in validation studies of air pollution prediction models
[COO-2874-50] N80-15665
SANDIA LABS., ALBUQUERQUE, N. MEX.
Refractory metals for ultrasonic thermometry application
[NUREG-CR-0368] N80-15253
Electrical activity in shock-loaded polymers
[SAND-79-0592C] N80-15270
Synthesis and characterization of new polyether based soluble polyurethanes
[SAND-78-1866C] N80-15273
Low temperature reaction path for coal liquefaction
[SAND-79-0730C] N80-15288
High current testing of lightning arrestor connectors
[SAND-74-0326] N80-15347
Sympathetic breakdown in gaps in air
[SAND-79-0598C] N80-15355
FLUFLOW: An appended code for calculating heat transfer to a fluid
[SAND-78-8271] N80-15377
Structural modeling of a thick-rim rotor
[SAND-78-1941C] N80-15416
HONDO II: A finite element computer program for the large deformation dynamic response of axisymmetric solids
[SAND-78-0422] N80-15442
Design of photovoltaic systems for residential applications in the United States
[SAND-78-2186C] N80-15566
Methodology for determining the configuration of the optimum solar total energy system
[SAND-79-0422] N80-15574
User's manual for computer code SOLTES-1 [Simulator Of Large Thermal Energy Systems]
[SAND-78-1315-REV] N80-15575
Design and performance of silicon solar cells under concentrated sunlight
[SAND-79-1165C] N80-15577
Status of the US Department of Energy photovoltaic concentrator development project
[SAND-78-2187C] N80-15578
Evaluation of the evacuated solar annular receivers used at the Midtemperature Solar Systems Test Facility [MSSTF]
[SAND-78-0983] N80-15585
Dynamic storage in solar total energy programs
[SAND-78-0958C] N80-15600
Department of Energy large solar central power systems semiannual review
[SAND-78-8511] N80-15601
Department of Energy large solar central power systems semiannual review
[SAND-79-8508] N80-15602
Thermal model of a thermal battery
[SAND-79-0834] N80-15607
Long-term lithium battery tests
[SAND-79-0487] N80-15608
Development of a portable specular reflectometer for field measurements of solar mirror materials
[SAND-78-1918] N80-15617
Overview of flywheel energy storage component development
[SAND-78-1998C] N80-15623
Sandia composite-rim flywheel development
[SAND-78-1865C] N80-15624
PULSAR: An inductive pulse power source
[SAND-79-1246C] N80-15627
Solar mechanical energy storage program overview and systems analysis results
[SAND-79-1642C] N80-15637
Solar enhanced oil recovery: An assessment of economic feasibility
[SAND-79-0787] N80-15641
Attempt to measure sonic boom caustics supersonic HVAR rocket sleds
[SAND-78-1541] N80-15878
Pulsed power for fusion
[SAND-79-0933C] N80-15908
Auger lineshape analysis of molecules and solids
[SAND-79-1240C] N80-15956
Aims and accomplishments of surface theory
[SAND-79-1150C] N80-15964
Dielectric strength of SiO2 in a CMOS transistor structure
[SAND-79-1715C] N80-15965
Pathogen reduction in sludges by irradiation
[SAND-78-1957C] N80-15996
SANDIA LABS., LIVERMORE, CALIF.
Calculation of plane sudden expansion flow via vortex dynamics
[SAND-79-8679] N80-15374
Numerical rank determination in linear least squares problems
[SAND-79-8243] N80-15861
SCHOOL OF AEROSPACE MEDICINE, BROOKS AFB, TEX.
Biochemical indices of stress: Biochemical aspects of the stress response N80-15812
Management of irregular rest and activity N80-15819
SCIENCE APPLICATIONS, INC., BERKELEY, CALIF.
Transient analysis of multiconductor transmission line networks: A comparison of experimental and numerical results
[AD-A074950] N80-15344
SCIENCE APPLICATIONS, INC., MCLEAN, VA.
The effect of inaccuracies in meteorological parameters on one-dimensional forecasts of upper ocean thermal structure
[AD-A073539] N80-15748
A model of diurnal variability of the ocean-atmosphere system in the undisturbed trade wind regime
[AD-A073540] N80-15749
SKIDAWAY INST. OF OCEANOGRAPHY, SAVANNAH, GA.
Trace element geochemistry of the South Atlantic bight
[DOE/EV-00890-3] N80-15774
SOLAREX CORP., ROCKVILLE, MD.
Economical space power systems
[NASA-CR-159696] N80-15559
SOUTH CAROLINA UNIV., COLUMBIA.
Intensive archeological survey of a potential defense waste processing facility site, Savannah River Plant, Aiken and Barnwell Counties, South Carolina. Research manuscript series 149
[DOE/SR-01072-3] N80-15913
Intensive archeological survey of a potential independent spent fuel storage facility, Savannah River Plant, Aiken and Barnwell Counties, South Carolina, research manuscript series 141
[DOE/SR-01072-1] N80-15914
SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY, RAPID CITY.
Application of a two-dimensional cloud model to cloud seeding experiments
[PB-298997/1] N80-15769
SOUTHWEST FOUNDATION FOR RESEARCH AND EDUCATION, SAN ANTONIO, TEX.
Contaminants N80-15790
SOUTHWEST RESEARCH INST., SAN ANTONIO, TEX.
The physical and chemical characterization of ten military turbine engine lubricants
[AD-A074073] N80-15765
Crack tip plasticity associated with corrosion assisted fatigue
[AD-A073835] N80-15435
Airborne aeroallergen measurements in Houston, Texas
[PB-299643/7] N80-15697
SPIRE CORP., BEDFORD, MASS.
Research on low temperature, directed energy processing of very large scale integrated structures
[AD-A074127] N80-15340
SRI INTERNATIONAL CORP., MENLO PARK, CALIF.
Mission analysis for the Federal fuels from biomass program. Volume 3: Feedstock availability
[SAN-0115-T1] N80-15276
Economic impacts of energy conservation and renewable energy sources
[UCRL-15087] N80-15633
Documentation of the analysis of the benefits and costs of aeronautical research and technology models, volume I
[NASA-CR-152278] N80-15865
Documentation of the Analyses of the Benefits and Costs of Aeronautical Research and Technology models [ABC-ART]. Volume 2: Appendices
[NASA-CR-152279] N80-15866
STANFORD LINEAR ACCELERATOR CENTER, CALIF.
RF power saving in large storage rings
[SLAC-TN-79-2] N80-15353
Aspects of computer control from the human engineering standpoint
[SLAC-PUB-2307] N80-15831
Quark structure functions of mesons, fragmentation functions, higher-twist effects in QCD, deep inelastic scattering, and the Drell-Yan process
[SLAC-PUB-2362] N80-15883
Production of neutrinos and neutrino-like particles in proton-nucleus interactions
[SLAC-216] N80-15891
STANFORD UNIV., CALIF.
Steady-state point-source excitation of a laminated composite
[AD-A074336] N80-15207
Combustion noise
[NASA-CR-162571] N80-15215
Pressure fluctuations on the surface of a cylinder in uniform flow
[NASA-CR-162468] N80-15362
Full-coverage film cooling on flat, isothermal surfaces: Data and predictions
[NASA-CR-3219] N80-15363
Geological and geothermal data use investigations for application explorer mission-A, heat capacity mapping mission
[E80-10033] N80-15528
The investigation of man-made modifications of the ionosphere
[NASA-CR-162579] N80-15707
Design and verification of reliable software
[AD-A074224] N80-15839
Characterization of acoustic disturbances in linearly sheared flows
[NASA-CR-162577] N80-15869
Features of sound propagation through and stability of a finite shear layer
[NASA-CR-162465] N80-15870
An experimental study of the structure and acoustic field of a jet in a cross stream
[NASA-CR-162464] N80-15871
On the output of acoustical sources
[NASA-CR-162576] N80-15872
Acoustic resonances and sound scattering by a shear layer
[NASA-CR-162575] N80-15873
Acoustically scanned optical imaging devices
[AD-A074954] N80-15915
Acoustic microscopy at cryogenic temperatures
[AD-A074502] N80-15919
A structural model for database systems
[AD-A074077] N80-15985
Induction over large data bases
[AD-A074075] N80-15987
STATE UNIV. OF NEW YORK AT ALBANY.
Electric characteristics of ion-implanted laser-annealed silicon
[CONF-780932-4] N80-15352
STATE UNIV. OF NEW YORK AT BUFFALO.
Design criteria for optimal flight control systems
[AD-A074092] N80-15139
Considerations in the optical characterization of the atmosphere
[AD-A073480] N80-15747

SYRACUSE RESEARCH CORP., N. Y.
Project evaluation and quality control [PB-300661/9] N80-15647
SYRACUSE UNIV., N. Y.
Electromagnetic transmission through an annular aperture in an infinite conducting screen [AD-A074831] N80-15320

T

TECHNICAL REPORT SERVICES, ROCKY RIVER, OHIO.
Evaluation of feasibility of prestressed concrete for use in wind turbine blades [NASA-CR-159722] N80-15553
TECHNION - ISRAEL INST. OF TECH., HAIFA.
A differential dynamic programming algorithm for the solution of the three-dimensional optimal missile avoidance [TAE-351] N80-15835
TECHNOLOGY, INC., DAYTON, OHIO.
Application of the SIRS concept to Navy helicopters [AD-A074801] N80-15050
TEL-AVIV UNIV. [ISRAEL].
Daily high-latitude 150 mb pressure maps from Twerle [Tropical Wind, reference level and energy conversion experiment] and synsmondes. Part 1: 16 November 1975 - 31 January 1976 [PB-301343/0] N80-15766
TENNESSEE UNIV., KNOXVILLE.
Vacuum ultraviolet electronic properties of liquids [ORO-3861-28] N80-15217
TENNESSEE UNIV. SPACE INST., TULLAHOMA.
Fundamental studies of subsonic and transonic flow separation. Part 3: Third phase summary report [AD-A074868] N80-15057
TEXAS A&M RESEARCH FOUNDATION, COLLEGE STATION.
Conversion of coal-based methanol to ethylene and a gaseous fuel [PB-301256/4] N80-15297
TEXAS A&M UNIV., COLLEGE STATION.
On the clustering of multidimensional pictorial data N80-15493
Multiyear estimates for the LACIE sampling plans N80-15517
Fast numerical calculations of ion-atom collisions [CONF-7905111-1] N80-15880
Nucleon-nucleon scattering phase shifts [ORO-5223-12] N80-15885
Phase matrix measurements for electromagnetic scattering by sphere aggregates [AD-A074466] N80-15916
Measurement of polarized light scattering via the Mueller matrix [AD-A074431] N80-15922
Velocity model of the shallow lunar crust [NASA-CR-162573] N80-16014
TEXAS INSTRUMENTS, INC., DALLAS.
Limited vocabulary continuous word recognition [AD-A074206] N80-15309
TEXAS TECHNOLOGICAL UNIV., LUBBOCK.
Studies of HoFe oligomeric species [AD-A074177] N80-15260
TEXAS UNIV., AT AUSTIN.
CTS attenuation and cross polarization measurements at 11.7 GHz [NASA-CR-159952] N80-15308
TEXTRON BELL HELICOPTER, FORT WORTH, TEX.
Analysis of low-speed helicopter flight test data [AD-A074141] N80-15079
TOTAL ENVIRONMENTAL ACTION, INC., HARRISVILLE, N.H.
Design of residential buildings utilizing natural thermal storage [DOE/TIC-10143] N80-15302
TRANSPORTATION RESEARCH BOARD, WASHINGTON, D.C.
Pavement evaluation and overlay design. A symposium and refereed papers [PB-299896/1] N80-15305
Quality Assurance: Performance, waiters and materials variation [PB-299895/3] N80-15306
Urban transportation planning, evaluation, and analysis [PB-300749/9] N80-15999
New transportation systems and technology, 1979. Transportation research record 708 [PB-300747/3] N80-16000
TRANSPORTATION SYSTEMS CENTER, CAMBRIDGE, MASS.
The effects of primary power transmission lines on the performance of LORAN-C receivers in experimental terrestrial applications [PB-301367/9] N80-15066
TRW DEFENSE AND SPACE SYSTEMS GROUP, HOUSTON, TEX.
Detailed description of the HP-9825A HFRMP trajectory processor [TRAJ] [NASA-CR-160440] N80-15836
TRW DEFENSE AND SPACE SYSTEMS GROUP, REDONDO BEACH, CALIF.
Analyses of moisture in polymers and composites [NASA-CR-159745] N80-15264
Coal sulfur measurements [PB-299575/1] N80-15294
TRW EQUIPMENT LABS., CLEVELAND, OHIO.
FRS composites for advanced gas turbine engine components [AD-A074287] N80-15137
TRW, INC., CLEVELAND, OHIO.
Solar power satellite system definition study. Volume 1: Executive summary [NASA-CR-160642] N80-15195
TUTHILL PUMP CO., SAN RAFAEL, CALIF.
Evaluation of feasibility of prestressed concrete for use in wind turbine blades [NASA-CR-159725] N80-15553

U

ULTRASYSTEMS, INC., IRVINE, CALIF.
Coal mine combustion products identification and analysis: Procedures and summary [PB-299550/5] N80-15545
UNITED TECHNOLOGIES RESEARCH CENTER, EAST HARTFORD, CONN.
Investigation of plasma processes in electronic transmission lasers [AD-A074892] N80-15394
UTAH STATE UNIV., BEDFORD, MASS.
Interpretation of NO and OH emission from 1976 airborne measurements [AD-A073898] N80-15661
UTAH STATE UNIV., LOGAN.
Waste stabilization lagoon microorganism removal efficiency and effluent disinfection with chlorine [PB-300631/9] N80-15786
UTAH UNIV., SALT LAKE CITY.
Conference on performance monitoring techniques for evaluation of solar heating and cooling systems [CONF-780432] N80-15599

V

VARIAN ASSOCIATES, PALO ALTO, CALIF.
Indium phosphide Gunn devices [26-40GHz] [AD-A074549] N80-15330
VILLANOVA UNIV., PA.
Investigation of microwave circuits that are suitable for application to integrate with the Pound-Leibys' plasma millimeter wave tube [AD-A074988] N80-15925
VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
Numerical prediction of flows over and in the near wake behind axisymmetric, self-propelled bodies [AD-A074971] N80-15371
User's guide for a system of computer programs to predict flows over and in the near wake behind axisymmetric, self-propelled bodies [AD-A074972] N80-15372
VIRGINIA UNIV., CHARLOTTESVILLE.
Investigation of elongation and its relationship to residual stresses in boron filaments [AD-A074440] N80-15210
VISIDYNE, INC., BURLINGTON, MASS.
Rocketborne laser backscatter experiment [AD-A073653] N80-15398

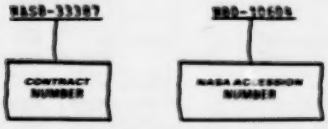
W

WASHINGTON STATE UNIV., PULLMAN.
A program of management and technical assistance in the state of Washington [PB-299276/8] N80-15977
WASHINGTON UNIV., SEATTLE.
Airborne studies of atmospheric aerosol in the High Plains and the structures of natural and artificially seeded clouds in eastern Montana [PB-299026/5] N80-15770
Far-field matching for tidal calculations in nearshore regions [PB-299016/6] N80-15777
WASHINGTON UNIV., ST. LOUIS, MO.
Fatigue failure of composite laminates [AD-A073899] N80-15209
WEATHER WING [3RD], OFFUTT AFB, NEBR.
Moisture advection and the Sangster chart [AD-A073432] N80-15744
WESTINGHOUSE ELECTRIC CORP., LESTER, PA.
Turbine cycle performance improvement through titanium LP blades [EPRI-AF-903] N80-15417
WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
Analysis of the early phase of Tokamak plasma ohmic heating [WFPS-TME-79-016] N80-15927
WESTINGHOUSE RESEARCH AND DEVELOPMENT CENTER, PITTSBURGH, PA.
Environmental hydrogen cracking of HY steel weld metals [AD-A074109] N80-15237
WHARTON [E. F. A.], INC., PHILADELPHIA, PA.
Wharton annual energy model: Development and simulation results [EPRI-EA-1115] N80-15606
WISCONSIN UNIV. - MADISON.
Assessment of research directions for high voltage direct current power systems [COO-5014-9] N80-15348
Daily high-latitude 150 mb pressure maps from Twerle [Tropical Wind, reference level and energy conversion experiment] and synsmondes. Part 1: 16 November 1975 - 31 January 1976 [PB-301343/0] N80-15766
Investigation of adaptive control for recoil mechanisms [AD-A074026] N80-15851
WISCONSIN UNIV., MADISON.
Stimulated Thomson scattering [COO-2387-104] N80-15963
WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.
Woods Hole Oceanographic Institution Collection of Climatology and Air/Sea Interaction [CASI] data [AD-A075009] N80-15729
Analysis and interpretation of tidal currents in the coastal boundary layer [PB-299428/3] N80-15775
WRIGHT STATE UNIV., DAYTON, OHIO.
Low temperature electron irradiation and annealing of pure cadmium [COO-1198-1274] N80-15246
WYOMING UNIV., LARAMIE.
Energy absorption mechanisms during crack propagation in metal matrix composites [NASA-CR-162574] N80-15232

Y

YALE UNIV., NEW HAVEN, CONN.
Theory of deposition of condensible impurities on surfaces immersed in combustion gases [NASA-CR-159716] N80-15130
Experimental studies of the formation/deposition of sodium sulfate in/from combustion gases [NASA-CR-159753] N80-15131

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

AF PROJ. 3173
N80-15343
N80-15735

AF PROJ. 3291
N80-15055

AF PROJ. 6491
N80-15920
N80-15950

AF PROJ. 0173
N80-15986

AF PROJ. 1123
N80-15180

AF PROJ. 1209
N80-15319

AF PROJ. 2007
N80-15056

AF PROJ. 2128
N80-15196

AF PROJ. 2301
N80-15241

AF PROJ. 2302
N80-15268

AF PROJ. 2304
N80-15054
N80-15839
N80-15867

AF PROJ. 2305
N80-15954

AF PROJ. 2307
N80-15136
N80-15366
N80-15432

AF PROJ. 2311
N80-15711
N80-15712

AF PROJ. 2419
N80-15209

AF PROJ. 2421
N80-15413

AF PROJ. 3763
N80-15344

AF PROJ. 4027
N80-15309

AF PROJ. 4600
N80-15318
N80-15332

AF PROJ. 4643
N80-15717

AF PROJ. 6670
N80-15714

AF PROJ. 6687
N80-15715

AF PROJ. 6690
N80-15398

AF PROJ. 7184
N80-15800

AF PROJ. 7670
N80-15661
N80-15713

AF PROJ. 9996
N80-15321

AF-AFOSR-2824-75
N80-15136

AF-AFOSR-3108-76
N80-15241

AF-AFOSR-3181-77
N80-15844

AF-AFOSR-3458-77
N80-15834
N80-15835

AF-AFOSR-3616-78
N80-15268

AF-AFOSR-3664-78
N80-15925

ARPA ORDER 2778
N80-15915

ARPA ORDER 3466
N80-15342

ARPA ORDER 3713
N80-15340

ARPA ORDER 3747
N80-15392

CSA-30200-L-76-01
N80-15687

DA PROJ. 1F2-62209-AH-76
N80-15081

DA PROJ. 1L1-61101-A-91A
N80-15337
N80-15390

DA PROJ. 1L1-61102-AH-43
N80-15316
N80-15917

DA PROJ. 1L1-61102-AH-44
N80-15341
N80-15845

DA PROJ. 1L1-61102-AH-45
N80-15031

DA PROJ. 1L1-61102-B-53A
N80-15740

DA PROJ. 1L1-62111-AH-71
N80-15731
N80-15747

DA PROJ. 1L2-62209-AH-76
N80-15079

DA PROJ. 1L7-62701-AH-92
N80-15315

DA PROJ. 1T1-61101-A-91A
N80-15541

DA PROJ. 1T6-65702-D-126
N80-15736
N80-15737
N80-15738
N80-15739
N80-15741
N80-15742
N80-15743

DA PROJ. 4A7-62720-A-896
N80-15662

DAAB07-77-C-0142
N80-15322

DAAB07-77-C-0146
N80-15315

DAAD05-76-C-0730
N80-15581

DAAG29-76-D-0100
N80-15747

DAAG29-76-G-0331
N80-15310

DAAG29-77-G-0076
N80-15851

DAAG29-78-G-0075
N80-15851

DAAG29-78-G-0149
N80-15236

DAAG29-78-G-0162
N80-15827

DAAG53-76-C-0059
N80-15362

DAAJ02-77-C-0022
N80-15079

DAAK10-78-C-0152
N80-15414

DAAK10-78-C-0227
N80-15236

DAAK21-79-M-3448
N80-15951

DAAK70-78-C-0147
N80-15540

DAAK70-79-C-0142
N80-15265

DAHC04-75-G-0132
N80-15336

DARPA ORDER 2062
N80-15399

DASG60-78-C-0048
N80-15843

DCA100-73-C-0015
N80-15982

DE-AE29-76EI-20370
N80-15422

DE-AC02-79EV-10005
N80-15775

DE-AC03-76SF-00515
N80-15831

DE-AC04-76DP-00789
N80-15220
N80-15270
N80-15566
N80-15570

DE-AI01-79ET-20485
N80-15561

DEB3-54
N80-15263

DI-DR-HO-133004
N80-15545

DI-G-ET-79-11270
N80-15691

DI-S-07-DR-12100
N80-15769

DI-6-07-DR-20110
N80-15770

DI-14-06-D-7699
N80-15761

DI-14-34-0001-6103
N80-15552

DI-14-34-0001-7146
N80-15694

DI-14-34-0001-7172
N80-15785

DI-14-34-0001-7814
N80-16002

DNA001-78-C-0138
N80-15029

DOL-J-9-F-5-0070
N80-15231

DOT-CG-81-78-1833
N80-15830

DOT-FA76WAI-622
N80-15755

DOT-OS-70084
N80-16007

EC-77-A-31-1034
N80-15560

EC-77-C-05-5523
N80-15590

EC-77-S-04-3992
N80-15582

EDA-07-06-01792-1
N80-15977

EE-76-C-02-4234
N80-15278

EP-77-A-01-2593
N80-15235

EG-77-C-01-4042
N80-15570
N80-15571
N80-15583
N80-15639

EG-77-C-02-4042
N80-15579

EG-77-C-02-4231
N80-15927

EG-77-C-02-4258
N80-15284

EG-77-C-04-3787
N80-15597

EG-77-C-05-5444
N80-15603

EG-77-S-02-4264
N80-15884

EG-77-S-04-4094
N80-15599

ER-78-C-01-5050
N80-15591

ER-78-C-03-1735
N80-15613

ER-78-C-04-4297
N80-15569

ERD-77-2202
N80-15298

EPA-P-802360
N80-15695

EPA-P-803726-01
N80-15551

EPA-P-803875
N80-15608

EPA-P-803900
N80-16006

EPA-P-804891
N80-15675

EPA-68-01-3169
N80-15228

EPA-68-01-4146
N80-15692

EPA-68-01-4360
N80-15693

EPA-68-02-0609
N80-15701

EPA-68-02-1885
N80-15687

EPA-68-02-2162
N80-15676

EPA-68-02-2165
N80-15294

EPA-68-02-2183
N80-15672

EPA-68-02-2444
N80-15763

EPA-68-02-2585
N80-15702

EPA-68-02-2603
N80-15682

EPA-68-02-2608
N80-15689

EPA-68-02-2629
N80-15684

EPA-68-02-2688
N80-15805

EPA-68-02-2808
N80-15229

EPA-68-03-2151
N80-15786

EPA-68-03-2226
N80-15681

EPRI PROJ. 137-1
N80-15684

EPRI PROJ. 440-1
N80-15606

EPRI PROJ. 493
N80-15915

EPRI PROJ. 857-1
N80-15801

ER-78-S-02-4742
N80-15972

ER-78-S-02-4946
N80-15221

ES-77-C-02-4253
N80-15406

ET-78-C-02-5022
N80-15576

ET-78-S-02-5014
N80-15348

ET-78-S-05-5912
N80-15277

EV-78-C-01-6182
N80-15989

EW-78-C-06-1076
N80-15903

EW-78-S-09-1072
N80-15913
N80-15914

EX-76-I-01-1028
N80-15553

CONTRACT

EX-76-I-01-1041
NBO-15580
EY-76-C-02-0016
NBO-15225
NBO-15227
NBO-15255
NBO-15286
NBO-15302
NBO-15346
NBO-15385
NBO-15402
NBO-15403
NBO-15634
NBO-15773
NBO-15858
NBO-15897
EY-76-C-02-1150
NBO-15246
NBO-15349
EY-76-C-02-1764
NBO-15970
EY-76-C-02-2764
NBO-15567
EY-76-C-02-2900
NBO-15283
EY-76-C-02-3069
NBO-15082
NBO-15971
EY-76-C-02-3073
NBO-15907
NBO-15936
NBO-15941
EY-76-C-02-4094
NBO-15609
NBO-15635
NBO-15638
EY-76-C-03-0010
NBO-15935
EY-76-C-03-0115
NBO-15276
EY-76-C-03-0167
NBO-15251
EY-76-C-03-0515
NBO-15353
NBO-15883
NBO-15890
NBO-15891
EY-76-C-03-1331
NBO-15596
NBO-15636
EY-76-C-04-0053
NBO-15047
EY-76-C-04-0613
NBO-15957
EY-76-C-04-0656
NBO-15254
NBO-15269
NBO-15961
EY-76-C-04-0709
NBO-15253
NBO-15270
NBO-15273
NBO-15288
NBO-15347
NBO-15355
NBO-15374
NBO-15377
NBO-15416
NBO-15442
NBO-15574
NBO-15575
NBO-15577
NBO-15585
NBO-15586
NBO-15600
NBO-15601
NBO-15602
NBO-15607
NBO-15608
NBO-15617
NBO-15622
NBO-15623
NBO-15624
NBO-15627
NBO-15637
NBO-15641
NBO-15861
NBO-15878
NBO-15908
NBO-15956
NBO-15964
NBO-15965
NBO-15996
EY-76-C-04-3533
NBO-15257
EY-76-C-05-0033
NBO-15670
EY-76-C-07-1570
NBO-15384
NBO-15909
EY-76-S-02-1367
NBO-15245
EY-76-S-02-2210
NBO-15932
EY-76-S-02-2387
NBO-15963
EY-76-S-02-2577
NBO-15616
EY-76-S-02-2733
NBO-15438
NBO-15864
EY-76-S-02-2873
NBO-15223
EY-76-S-02-2874
NBO-15465
EY-76-S-02-2893
NBO-15595
EY-76-S-02-2993
NBO-15584
EY-76-S-02-2995
NBO-15962
EY-76-S-02-4045
NBO-15198
EY-76-S-02-4122
NBO-15483
EY-76-S-03-0034
NBO-15354
NBO-15966
EY-76-S-05-3106
NBO-15222
EY-76-S-05-3861
NBO-15217
EY-76-S-05-4837
NBO-15967
EY-76-S-05-5223
NBO-15885
EY-76-S-06-2227
NBO-15293
EY-76-S-09-0890
NBO-15774
EY-77-C-06-1059
NBO-15750
F04701-77-C-0078
NBO-15056
F04701-78-C-0079
NBO-15969
NBO-16017
F19628-76-C-0253
NBO-15398
F19628-77-C-0005
NBO-15712
F19628-77-C-0220
NBO-15954
F19628-78-C-0002
NBO-15196
NBO-15920
NBO-15950
F19628-78-C-0018
NBO-15661
F29601-76-C-0048
NBO-15319
F29601-77-C-0047
NBO-15343
F29601-78-C-0002
NBO-15344
F30602-77-C-0139
NBO-15309
F30602-77-C-0150
NBO-15986
F33615-77-C-5053
NBO-15209
F40600-76-C-0006
NBO-15057
F49620-76-C-0004
NBO-15054
F49620-77-C-0045
NBO-15839
F49620-77-C-0050
NBO-15711
F49620-77-C-0107
NBO-15366
F49620-79-C-0161
NBO-15867
F49620-79-C-0169
NBO-15832
MDA903-77-C-0322
NBO-15985
NBO-15987
MDA903-77-C-0331
NBO-15842
MDA903-78-C-0445
NBO-15868
MDA903-79-C-0212
NBO-15340
NASA ORDER C-25906
NBO-15553
NASA ORDER H-19386-B
NBO-15660
NASA ORDER S-40255-B
NBO-15533
NASA ORDER S-70243-AG
NBO-15526
NASW-3198
NBO-15704
NBO-15780
NBO-15781
NBO-15798
NBO-15799
NASW-3199
NBO-15778
NBO-15779
NBO-15782
NBO-15783
NBO-15796
NBO-15797
NBO-15822
NBO-15837
NBO-15973
NAS1-13871
NBO-15070
NBO-15071
NBO-15072
NAS1-14193
NBO-15299
NAS1-15044
NBO-15380
NAS1-15057
NBO-15074
NBO-15075
NAS1-15072
NBO-15423
NBO-15424
NAS1-15119
NBO-15539
NAS1-15128
NBO-15052
NAS1-15305
NBO-15048
NBO-15049
NAS1-15343
NBO-15062
NAS2-10026
NBO-15865
NBO-15866
NAS3-14336
NBO-15363
NAS3-18021
NBO-15083
NBO-15084
NBO-15085
NBO-15086
NBO-15087
NBO-15088
NBO-15089
NBO-15090
NBO-15091
NBO-15092
NBO-15093
NBO-15094
NBO-15095
NBO-15096
NBO-15097
NBO-15098
NBO-15099
NBO-15100
NBO-15101
NBO-15102
NBO-15103
NBO-15104
NBO-15105
NBO-15106
NBO-15107
NBO-15108
NBO-15109
NBO-15110
NBO-15111
NBO-15112
NBO-15113
NBO-15114
NBO-15115
NBO-15116
NBO-15117
NBO-15118
NBO-15119
NBO-15120
NBO-15121
NBO-15122
NBO-15123
NBO-15124
NBO-15125
NBO-15126
NAS3-20373
NBO-15202
NAS3-20406
NBO-15264
NAS3-20596
NBO-15553
NAS3-21263
NBO-15411
NAS3-21353
NBO-15559
NAS3-30813
NBO-15553
NAS4-2519
NBO-15073
NAS5-22459
NBO-15381
NAS5-22576
NBO-15308
NAS5-23274
NBO-16008
NAS5-24164
NBO-16011
NAS5-24232
NBO-15528
NAS5-25010
NBO-15705
NAS5-25020
NBO-15536
NAS6-2519
NBO-15406
NAS7-100
NBO-15529
NASB-31293
NBO-15563
NASB-32660
NBO-15194
NASB-32898
NBO-15706
NASB-33107
NBO-15948
NASB-33195
NBO-16016
NASB-33374
NBO-15825
NASB-33452
NBO-15203
NASB-33576
NBO-15412
NAS9-14282
NBO-15511
NAS9-14403
NBO-15199
NAS9-14533
NBO-15511
NAS9-14565
NBO-15499
NAS9-14689
NBO-15493
NBO-15496
NAS9-14723
NBO-15836
NAS9-15000
NBO-15496
NAS9-15114
NBO-15703
NAS9-15200
NBO-15494
NBO-15495
NAS9-15476
NBO-15534
NAS9-15636
NBO-15195
NAS9-15779
NBO-15186
NBO-15187
NBO-15188
NBO-15189
NBO-15190
NBO-15191
NAS9-15792
NBO-15307
NGL-05-020-526
NBO-15871
NGL-06-003-057
NBO-16008
NGL-33-018-003
NBO-15076
NGR-05-020-091
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NGR-05-020-676
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NGR-22-009-646
NBO-16013
NGR-33-016-086
NBO-15728
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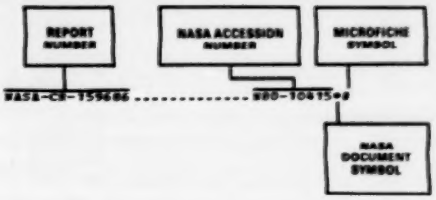
NBO-15063
NBO-15064
NGR-39-009-017
NBO-15065
NOAA-04-E01-9
NBO-15760
NOAA-04-7-158-44021
NBO-15777
NR PROJ. 053-636
NBO-15955
NR PROJ. 064-571
NBO-15240
NR PROJ. 064-609
NBO-15208
NSF AER-74-20135
NBO-15297
NSF AER-75-02665
NBO-15296

NSF APR-75-13864 NBD-15261
NSF APR-76-12036 NBD-15979
NSF ATM-77-01475 NBD-15729
NSF ATM-77-02520 NBD-15768
NSF ATM-77-13757 NBD-15724
NSF ATM-77-23757 NBD-15766 NBD-15767 NBD-15771
NSF DAR-78-17826 NBD-15979
NSF DMR-76-80847 NBD-15239
NSF ENV-77-15086 NBD-15998
NSF ERS-77-03206 NBD-15978
NSF GP-39737 NBD-15949
NSF INT-77-15160 NBD-15328
NSF RCS-75-22255 NBD-15852
NSF OCE-76-00406 NBD-15777
NSF OCE-77-27735 NBD-15768
NSF OPA-78-25354 NBD-16005
NSF PHY-79-00272 NBD-15968
NSF 76-20027 NBD-15725
NSG-1297 NBD-15205
NSG-1473 NBD-15201
NSG-1551 NBD-15853
NSG-2007 NBD-15362 NBD-15869 NBD-15871
NSG-2053 NBD-16012
NSG-2215 NBD-15869 NBD-15872
NSG-2233 NBD-15869 NBD-15873
NSG-2308 NBD-15873
NSG-3046 NBD-15300
NSG-3075 NBD-15360
NSG-3107 NBD-15130
NSG-3169 NBD-15131
NSG-3214 NBD-15233
NSG-3217 NBD-15232
NSG-6014 NBD-15708
NSG-6026 NBD-15058
NSG-7417 NBD-16014
NSG-9071 NBD-16015
N01-AM-8-2205 NBD-15803
N00014-74-C-0050 NBD-15173
N00014-74-C-0262 NBD-15729
N00014-75-C-0379 NBD-15301
N00014-75-C-0537 NBD-15916 NBD-15922
N00014-75-C-0556 NBD-15975
N00014-75-C-0580 NBD-15239
N00014-75-C-0919 NBD-15352
N00014-75-C-0951 NBD-15920
N00014-75-C-1038 NBD-15435
N00014-75-C-1106 NBD-15389
N00014-75-C-1115 NBD-15331
N00014-76-C-0054 NBD-15207
N00014-76-C-0129 NBD-15915
N00014-76-C-0225 NBD-15320
N00014-76-C-0231 NBD-15240 NBD-15431
N00014-76-C-0370 NBD-15052
N00014-76-C-0603 NBD-15823
N00014-76-C-0694 NBD-15210
N00014-76-C-0760 NBD-15393
N00014-76-C-0847 NBD-15394
N00014-76-C-1077 NBD-15952
N00014-77-C-0206 NBD-15732
N00014-77-C-0366 NBD-15216
N00014-77-C-0372 NBD-15237
N00014-77-C-0387 NBD-15949
N00014-77-C-0412 NBD-15919
N00014-77-C-0432 NBD-15955
N00014-78-C-0155 NBD-15139
N00014-78-C-0287 NBD-15748 NBD-15749
N00014-78-C-0559 NBD-15433
N00014-78-C-0647 NBD-15208
N00014-78-C-0799 NBD-15369
N00014-79-WR-90174 NBD-15392
N00019-75-C-0396 NBD-15077
N00019-77-C-0318 NBD-15030
N00019-78-C-0175 NBD-15984
N00019-78-C-0479 NBD-15918
N00019-79-C-0240 NBD-15333
N00019-79-C-0281 NBD-15311
N00123-77-C-0859 NBD-15330
N00173-77-C-0240 NBD-15716
N00173-77-C-0246 NBD-15335
N00173-78-C-0041 NBD-15323
N00173-78-C-0421 NBD-15367
N00173-78-C-0437 NBD-15953
N00173-78-C-0470 NBD-15399
N62269-77-C-0217 NBD-15137
N62269-77-C-0437 NBD-15368
N62269-78-C-0286 NBD-15135
PROJ. CAREIS NBD-15526
PROJ. 6987 NBD-15597
RR0110941 NBD-15926
RR0230183 NBD-15369
SP54592201 NBD-15137
SRI PROJ. 01-4901 NBD-15697
SRI PROJ. 7759 NBD-15865 NBD-15866
W-31-109-ENG-38 NBD-15247 NBD-15259 NBD-15281 NBD-15285 NBD-15350 NBD-15376
NBD-15436 NBD-15572 NBD-15573 NBD-15587 NBD-15588 NBD-15589 NBD-15611 NBD-15614 NBD-15629 NBD-15664 NBD-15704 NBD-15848 NBD-15860 NBD-15863 NBD-15942 NBD-15960 NBD-15997
W-7405-ENG-26 NBD-15224 NBD-15226 NBD-15242 NBD-15250 NBD-15252 NBD-15258 NBD-15351 NBD-15352 NBD-15356 NBD-15359 NBD-15383 NBD-15404 NBD-15425 NBD-15440 NBD-15441 NBD-15444 NBD-15581 NBD-15619 NBD-15620 NBD-15625 NBD-15862 NBD-15877 NBD-15879 NBD-15880 NBD-15887 NBD-15895 NBD-15906 NBD-15943 NBD-15959
W-7405-ENG-36 NBD-15211 NBD-15289 NBD-15324 NBD-15345 NBD-15382 NBD-15400 NBD-15402 NBD-15405 NBD-15426 NBD-15439 NBD-15565 NBD-15643 NBD-15718 NBD-15751 NBD-15820 NBD-15855 NBD-15856 NBD-15857 NBD-15892 NBD-15902 NBD-15905 NBD-15912 NBD-15931 NBD-15934 NBD-15937 NBD-15940 NBD-15945 NBD-15958 NBD-15988 NBD-16019
W-7405-ENG-48 NBD-15182 NBD-15183 NBD-15212 NBD-15213 NBD-15218 NBD-15219 NBD-15243 NBD-15244 NBD-15256 NBD-15272
NBD-15282 NBD-15292 NBD-15303 NBD-15357 NBD-15358 NBD-15373 NBD-15375 NBD-15376 NBD-15401 NBD-15407 NBD-15408 NBD-15437 NBD-15568 NBD-15568 NBD-15610 NBD-15612 NBD-15618 NBD-15626 NBD-15628 NBD-15632 NBD-15633 NBD-15666 NBD-15668 NBD-15719 NBD-15720 NBD-15802 NBD-15849 NBD-15859 NBD-15881 NBD-15886 NBD-15888 NBD-15894 NBD-15896 NBD-15898 NBD-15899 NBD-15904 NBD-15910 NBD-15911 NBD-15921 NBD-15928 NBD-15929 NBD-15930 NBD-15933 NBD-15938 NBD-15939 NBD-15944 NBD-15995
W-7405-ENG-82 NBD-15248 NBD-15271 NBD-15889
WP52551792 NBD-15732 NBD-15733
WR0410101101 NBD-15082
ZP12151001 NBD-15709
ZP61112001 NBD-15826
010-01-01 NBD-15033
177-52-83-13 NBD-15535
198-30-02 NBD-15726
199-99-00-00-72 NBD-15649 NBD-15788
352-03-03 NBD-15854
505-02 NBD-15428
505-02-54 NBD-15068
505-04 NBD-15128 NBD-15361 NBD-15410
505-09-31 NBD-15821
505-09-41 NBD-15069
505-10-23-03 NBD-15031
505-33-53-03 NBD-15874
505-42-13 NBD-15875
506-21-12 NBD-15202
506-53-53-01 NBD-15430
535-03-14 NBD-15028
744-01-01 NBD-15067
778-35-03 NBD-15263
790-40-37-00-72 NBD-16009

Typical Report/Accession Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A-6961 ..... N80-15129*#
A-7556 ..... N80-15033*#
A-7696 ..... N80-15021*#
A-7740 ..... N80-15067*#
A-7777 ..... N80-15138*#
A-7875 ..... N80-15069*#
A-7938 ..... N80-15726*#
A-7959 ..... N80-15854*#

AD-A070569 ..... N80-16018 #
AD-A071410 ..... N80-15180 #
AD-A072276 ..... N80-15208 #
AD-A072842 ..... N80-15366 #
AD-A073387 ..... N80-15741 #
AD-A073389 ..... N80-15742 #
AD-A073390 ..... N80-15743 #
AD-A073391 ..... N80-15739 #
AD-A073392 ..... N80-15737 #
AD-A073393 ..... N80-15738 #
AD-A073394 ..... N80-15736 #
AD-A073432 ..... N80-15744 #
AD-A073445 ..... N80-15746 #
AD-A073446 ..... N80-15745 #
AD-A073467 ..... N80-15716 #
AD-A073480 ..... N80-15747 #
AD-A073539 ..... N80-15748 #
AD-A073540 ..... N80-15749 #
AD-A073567 ..... N80-15841 #
AD-A073678 ..... N80-15323 #
AD-A073716 ..... N80-15717 #
AD-A073728 ..... N80-15740 #
AD-A073835 ..... N80-15435 #
AD-A073837 ..... N80-15840 #
AD-A073848 ..... N80-15367 #
AD-A073852 ..... N80-15712 #
AD-A073853 ..... N80-15398 #
AD-A073854 ..... N80-15842 #
AD-A073877 ..... N80-15193 #
AD-A073888 ..... N80-15396 #
AD-A073898 ..... N80-15661 #
AD-A073899 ..... N80-15209 #
AD-A073900 ..... N80-15322 #
AD-A073920 ..... N80-15952 #
AD-A073923 ..... N80-15828 #
AD-A073927 ..... N80-15829 #
AD-A073928 ..... N80-15313 #
AD-A073959 ..... N80-15730 #
AD-A073962 ..... N80-15338 #
AD-A073963 ..... N80-15334 #
AD-A073967 ..... N80-15975 #
AD-A073973 ..... N80-15197 #
AD-A073974 ..... N80-15885 #
AD-A073975 ..... N80-15192 #
AD-A073997 ..... N80-15848 #
AD-A073998 ..... N80-15949 #
AD-A074024 ..... N80-15851 #
AD-A074049 ..... N80-15181 #

AD-A074053 ..... N80-15830 #
AD-A074056 ..... N80-15331 #
AD-A074057 ..... N80-15433 #
AD-A074068 ..... N80-15846 #
AD-A074070 ..... N80-15370 #
AD-A074071 ..... N80-15369 #
AD-A074073 ..... N80-15265 #
AD-A074075 ..... N80-15987 #
AD-A074077 ..... N80-15985 #
AD-A074081 ..... N80-15982 #
AD-A074083 ..... N80-15950 #
AD-A074092 ..... N80-15139 #
AD-A074098 ..... N80-15136 #
AD-A074104 ..... N80-15237 #
AD-A074113 ..... N80-15236 #
AD-A074125 ..... N80-15208 #
AD-A074126 ..... N80-15399 #
AD-A074127 ..... N80-15380 #
AD-A074128 ..... N80-15078 #
AD-A074141 ..... N80-15079 #
AD-A074177 ..... N80-15268 #
AD-A074185 ..... N80-15238 #
AD-A074203 ..... N80-15414 #
AD-A074205 ..... N80-15986 #
AD-A074206 ..... N80-15309 #
AD-A074213 ..... N80-15843 #
AD-A074222 ..... N80-15241 #
AD-A074223 ..... N80-15867 #
AD-A074224 ..... N80-15839 #
AD-A074231 ..... N80-15196 #
AD-A074260 ..... N80-15054 #
AD-A074263 ..... N80-15316 #
AD-A074265 ..... N80-15321 #
AD-A074266 ..... N80-15343 #
AD-A074269 ..... N80-15434 #
AD-A074275 ..... N80-15710 #
AD-A074276 ..... N80-15731 #
AD-A074287 ..... N80-15137 #
AD-A074299 ..... N80-15984 #
AD-A074312 ..... N80-15056 #
AD-A074336 ..... N80-15207 #
AD-A074337 ..... N80-15732 #
AD-A074351 ..... N80-15917 #
AD-A074368 ..... N80-15397 #
AD-A074370 ..... N80-15709 #
AD-A074380 ..... N80-15392 #
AD-A074383 ..... N80-15955 #
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AD-A074626 ..... N80-15920 #

REPORT

AD-A074636 ..... MRC-15301 #
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AD-A074691 ..... MRC-15734 #
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AD-E430298 ..... MRC-15541 #

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AEDC-TR-78-66 ..... MRC-15055 #
AEDC-TR-79-43 ..... MRC-15838 #
AEDC-TR-79-48-PT-3 ..... MRC-15057 #

AFATL-TR-78-103 ..... MRC-15055 #

AFGL-AFSC-813-PT-4 ..... MRC-15735 #

AFGL-ERP-659 ..... MRC-15715 #
AFGL-ERP-661 ..... MRC-15713 #
AFGL-ERP-662 ..... MRC-15714 #

AFGL-TR-78-0224 ..... MRC-15717 #
AFGL-TR-79-0027 ..... MRC-15661 #
AFGL-TR-79-0041 ..... MRC-15712 #
AFGL-TR-79-0081 ..... MRC-15358 #
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AFGL-TR-79-0134-PT-4 ..... MRC-15735 #

AFHPL-TR-79-17 ..... MRC-15180 #

AFLRL-115 ..... MRC-15265 #

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AFOSR-79-1046TR ..... MRC-15925 #
AFOSR-79-1059TR ..... MRC-15711 #

AFWL-TR-78-123 ..... MRC-15343 #
AFWL-TR-78-152 ..... MRC-15348 #
AFWL-TR-78-160 ..... MRC-15056 #
AFWL-TR-78-243 ..... MRC-15319 #
AFWL-TR-79-402 ..... MRC-15321 #

AGARD-AR-140 ..... MRC-15140 #

AGARD-CP-262 ..... MRC-15149 #
AGARD-CP-278 ..... MRC-15141 #

AGARD-LS-105 ..... MRC-15806 #

AK-1-8-2205R-79 ..... MRC-15803 #

ALO-3787-4 ..... MRC-15597 #

ANRL-TR-79-23 ..... MRC-15800 #

ARL-CT-79-31 ..... MRC-15376 #
ARL-CT-79-34 ..... MRC-15587 #
ARL-CT-79-40 ..... MRC-15836 #
ARL-CT-79-49 ..... MRC-15997 #

ARL-79-50 ..... MRC-15860 #
ARL-79-53 ..... MRC-15863 #

ARL/ICES-TR-26 ..... MRC-15589 #
ARL/ICES-TR-30 ..... MRC-15588 #
ARL/MRD-78-11 ..... MRC-15942 #
ARL/OIEC-DCM-003 ..... MRC-15573 #
ARL/OIEC-DCM-035 ..... MRC-15572 #
ARL/PAS-78-37 ..... MRC-15285 #

APL/JHU/EQP-79-2 ..... MRC-15648 #

AS-2 ..... MRC-15839 #
AP-031-591 ..... MRC-15429 #
AP-001-598 ..... MRC-15421 #
AP-031-669 ..... MRC-15947 #

AP/IA/79-27 ..... MRC-15598 #

ARBRL-CR-00402 ..... MRC-15541 #

ARBRL-MR-02929 ..... MRC-15917 #

APL-MAT-8077-125 ..... MRC-15429 #

APL/MAT-REPT-109 ..... MRC-15421 #

APO-12528.1-P ..... MRC-15336 #
ARO-14012.5-EL ..... MRC-15310 #
ARO-14618.1-A-E ..... MRC-15851 #
ARO-15712.3-A-EL ..... MRC-15827 #
APO-15872.2-E ..... MRC-15206 #

AVRADCOM-TR-79-J(AM) ..... MRC-15067##
AVRADCOM-CR-79-34 ..... MRC-15361##
AVRADCOM-TR-79-42 ..... MRC-15128##

AWRE-O-9/79 ..... MRC-15391 #

BDX-613-2287 ..... MRC-15957 #

BRIC/TR9-78/7 ..... MRC-15667 #

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BR-IC-8792 ..... MRC-15588 #

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BNL-24906 ..... NBO-15897 #
BNL-25018 ..... NBO-15403 #
BNL-25068 ..... NBO-15773 #
BNL-26331 ..... NBO-15227 #
BNL-26390 ..... NBO-15638 #
BNL-26523 ..... NBO-15286 #
BNL-26543 ..... NBO-15658 #
BNL-26646 ..... NBO-15255 #

BULL-118 ..... NBO-15723 #

CALSPAN-6248-F-1 ..... NBO-15139 #

CE-79-125 ..... NBO-15419 #

CED-79-102 ..... NBO-15061 #
CED-79-115 ..... NBO-16003 #

CERL-TR-N-80 ..... NBO-15662 #

CGB/DC-13/79 ..... NBO-15830 #

CLOUD-PHYSICS-RESEARCH-13 ..... NBO-15770 #

CON-78-10869 ..... NBO-15924 #

CONF-751270-SUMM ..... NBO-15615 #
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CONF-780718-2 ..... NBO-15618 #
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CONF-780833-7 ..... NBO-15885 #
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CONF-790122-3 ..... NBO-15639 #
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CONF-790125-77 ..... NBO-15906 #
CONF-790127 ..... NBO-15220 #
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CONF-791028-3 ..... NBO-15355 #
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CONF-7811112-2 ..... NBO-15278 #
CONF-7905111-1 ..... NBO-15880 #
CONF-7906102-1 ..... NBO-15862 #
CONF-7906106-1 ..... NBO-15921 #
CONF-7906109-1 ..... NBO-15324 #
CONF-7906111 ..... NBO-16019 #

CONS/5058-T1 ..... NBO-15591 #

CONTRIB-78-268-A ..... NBO-15511** #
CONTRIB-1061 ..... NBO-15777 #

COO-1198-1264 ..... NBO-15349 #
COO-1198-1278 ..... NBO-15246 #
COO-1367-97 ..... NBO-15245 #
COO-1764-360 ..... NBO-15970 #
COO-2218-133 ..... NBO-15932 #
COO-2387-104 ..... NBO-15963 #
COO-2577-17 ..... NBO-15616 #
COO-2733-22 ..... NBO-15864 #
COO-2733-24 ..... NBO-15438 #
COO-2764-T3 ..... NBO-15567 #
COO-2873-3 ..... NBO-15223 #
COO-2874-50 ..... NBO-15665 #
COO-2893-9 ..... NBO-15595 #
COO-2900-17-VOL-2 ..... NBO-15283 #
COO-2982-38 ..... NBO-15291 #
COO-2993-1 ..... NBO-15584 #
COO-2995-3 ..... NBO-15962 #
COO-3069-T1 ..... NBO-15882 #
COO-3069-655 ..... NBO-15971 #
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COO-4094-41 ..... NBO-15638 #
COO-4094-44 ..... NBO-15609 #
COO-4094-48 ..... NBO-15635 #
COO-4122-27 ..... NBO-15443 #
COO-4253-7 ..... NBO-15406 #
COO-4258-1 ..... NBO-15284 #
COO-4264-3 ..... NBO-15884 #
COO-4297-1 ..... NBO-15569 #
COO-4742-1 ..... NBO-15972 #

CDC-4946-1 ..... PB0-15221 *
CDC-5016-9 ..... PB0-15348 *
CDC-5022-5 ..... PB0-15576 *

CDRADCOM-77-0142-1 ..... PB0-15322 *
CDRADCOM-77-0146-F ..... PB0-15315 *

CSC-TR-765 ..... PB0-15044 *

CSIR-CERC-281 ..... PB0-15388 *
CSIR-CERC-286 ..... PB0-15379 *
CSIR-CERC-290 ..... PB0-15230 *

CR-RR-77-008 ..... PB0-15103**
CR-RR-77-024 ..... PB0-15106**

DCF-R-23-01 ..... PB0-15369 *

DELNV-TR-79-2 ..... PB0-15390 *

DNEN/FOR/FDA-79/0672 ..... PB0-15804 *

DNE/RAP-1979-2 ..... PB0-16022 *

DFA-EAES-00 ..... PB0-15661 *

DOE/CS-0089 ..... PB0-15598 *
DOE/CS-0093 ..... PB0-15279 *
DOE/CS/5912-T1 ..... PB0-15277 *
DOE/EDP-0031 ..... PB0-15663 *
DOE/EDP-0034 ..... PB0-15621 *
DOE/EDP-0038 ..... PB0-15669 *
DOE/EIA-0102/2 ..... PB0-15592 *
DOE/EIA-0103/10 ..... PB0-15631 *
DOE/EIA-0104/1 ..... PB0-15594 *
DOE/EIA-0104/4 ..... PB0-15593 *
DOE/EIA-0192 ..... PB0-15630 *
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DOE/ER-0026 ..... PB0-15220 *
DOE/ET-0089 ..... PB0-15893 *
DOE/ET/20172-1 ..... PB0-15750 *
DOE/EV-00090-3 ..... PB0-15774 *
DOE/NASA/0054-79/1 ..... PB0-15263**
DOE/NASA/1034-79/6 ..... PB0-15560**
DOE/NASA/2593-79/12 ..... PB0-15235**
DOE/NASA/5906-79/1 ..... PB0-15553**
DOE/NASA/20370-79/19 ..... PB0-15422**
DOE/NASA/20485-79/6 ..... PB0-15561**
DOE/PE-0007 ..... PB0-15993 *
DOE/PE-0012 ..... PB0-15250 *
DOE/RA-0037 ..... PB0-15640 *
DOE/SL-90476-13 ..... PB0-15293 *
DOE/SR-01072-1 ..... PB0-15918 *
DOE/SR-01072-3 ..... PB0-15913 *
DOE/TIC-10143 ..... PB0-15902 *
DOE/TIC-10144 ..... PB0-15929 *
DOE/TIC-10193 ..... PB0-15580 *

DOT-RSPA-DPE-50-79-2 ..... PB0-16007 *

DOT-TSC-RSPA-79-8 ..... PB0-15066 *

DRDMI-T-79-50 ..... PB0-15317 *
DRDMI-T-79-62 ..... PB0-15983 *
DRDMI-T-79-65 ..... PB0-15846 *
DRDMI-T-79-66 ..... PB0-15197 *
DRDMI-T-79-69 ..... PB0-15395 *

DPIC-PB69056 ..... PB0-15391 *

DTNSRDC-79/075 ..... PB0-15434 *

D6-40837 ..... PB0-15052**
D180-25461-1 ..... PB0-15195**
D210-11168-3-VOL-3 ..... PB0-15077 *

E-063 ..... PB0-15419**
E-101 ..... PB0-15128**
E-126 ..... PB0-15234**
E-196 ..... PB0-15059**
E-234 ..... PB0-15132**
E-235 ..... PB0-15422**
E-251 ..... PB0-15133**
E-265 ..... PB0-15235**
E-266 ..... PB0-15538**
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E-294 ..... PB0-15876**
E-297 ..... PB0-15554**

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E-300 ..... PB0-15556**
E-301 ..... PB0-15557**
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E-303 ..... PB0-15561**
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E-324 ..... PB0-15368**
E-325 ..... PB0-15365**
E-9906 ..... PB0-15127**
E-9963 ..... PB0-15420**

EDA-79-0139 ..... PB0-15977 *

EDL-SRL-79-1 ..... PB0-15661 *

EDR-10085 ..... PB0-15811**

EMD-79-27 ..... PB0-15946 *

EPA-230/3-79-001 ..... PB0-15693 *
EPA-340/1-79-007 ..... PB0-15700 *
EPA-450/4-79-008A ..... PB0-15229 *
EPA-450/4-79-011 ..... PB0-15702 *
EPA-600/2-79-018 ..... PB0-15786 *
EPA-600/2-79-043 ..... PB0-16006 *
EPA-600/2-79-116 ..... PB0-15701 *
EPA-600/3-79-028 ..... PB0-15551 *
EPA-600/3-79-052 ..... PB0-15695 *
EPA-600/4-79-034 ..... PB0-15763 *
EPA-600/4-79-037 ..... PB0-15675 *
EPA-600/7-78-209 ..... PB0-15689 *
EPA-600/7-79-007 ..... PB0-15691 *
EPA-600/7-79-020 ..... PB0-15672 *
EPA-600/7-79-022C ..... PB0-15682 *
EPA-600/7-79-074 ..... PB0-15685 *
EPA-600/7-79-096 ..... PB0-15684 *
EPA-600/7-79-110-VOL-1 ..... PB0-15681 *
EPA-600/7-79-118 ..... PB0-15686 *
EPA-600/7-79-131 ..... PB0-15688 *
EPA-600/7-79-132 ..... PB0-15687 *
EPA-600/7-79-146 ..... PB0-15676 *
EPA-600/7-79-150 ..... PB0-15294 *
EPA-600/8-79-021 ..... PB0-15805 *
EPA-600/9-78-038 ..... PB0-15683 *
EPA-600/9-79-018 ..... PB0-16031 *
EPA-901/1-79-000 ..... PB0-15692 *

EPRI-AF-903 ..... PB0-15417 *

EPRI-EA-894 ..... PB0-15604 *
EPRI-EA-1115 ..... PB0-15606 *
EPRI-EA-1123-VOL-2 ..... PB0-15801 *

EPRI-ER-778-SP ..... PB0-15642 *

EPRI-RP-677 ..... PB0-15415 *

ER-7969-F ..... PB0-15137 *

ERADCOM/ASL-CR-79-0100-3 ..... PB0-15747 *
ERADCOM/ASL-DR-1036 ..... PB0-15741 *
ERADCOM/ASL-DR-1038 ..... PB0-15742 *
ERADCOM/ASL-DR-1039 ..... PB0-15743 *
ERADCOM/ASL-DP-1040 ..... PB0-15739 *
ERADCOM/ASL-DP-1041 ..... PB0-15737 *
ERADCOM/ASL-DR-1042 ..... PB0-15738 *
ERADCOM/ASL-DP-1043 ..... PB0-15736 *
ERADCOM/ASL-TR-0035 ..... PB0-15731 *
ERADCOM/ASL-TR-0036 ..... PB0-15740 *

ERC-R-79034 ..... PB0-15360**

ERIM-132400-28-F PB0-15534**

ERI-0078-TP ..... PB0-15947 *

ESD-TR-79-74 ..... PB0-15950 *
ESD-TP-79-167 ..... PB0-15920 *
ESD-TR-79-184 ..... PB0-15196 *

ESL-711847-2 ..... PB0-15311 *
ESL-784569-9 ..... PB0-15310 *

ETL-0194 ..... PB0-15540 *

EBO-10020 ..... PB0-15467**
ESO-10030 ..... PB0-15469**
EBO-10031 ..... PB0-15526**

E80-10032	N80-15527**
E80-10033	N80-15528**
E80-10035	N80-15529**
E80-10036	N80-15530**
E80-10037	N80-15531**
E80-10038	N80-15532**
E80-10039	N80-15533**
E80-10040	N80-15534**
FAA-EE-79-05	N80-15059**
FB-36	N80-15973**
FDA/BRH-79/114	N80-15804 *
FE-11270-1	N80-15691 *
FHWA/CT/RD-402-F-79-1	N80-15419 *
FHWA/LA-78-207L	N80-15723 *
FR-4	N80-15930 *
FSB-MET-STR-79-1	N80-15768 *
GA-A-15194	N80-15251 *
GALCIT-134B	N80-15366 *
GFPP-TIS-380	N80-15258 *
GFPP-TIS-443	N80-15961 *
GFPP-TIS-445	N80-15269 *
GIDEP-E117-0706	N80-15312 *
GL-3006	N80-15915 *
GPO-35-120	N80-15994 *
GPO-53-451	N80-15184 *
GRC-1070-04-79-CR	N80-15868 *
H-1046	N80-15068**
H-1109	N80-15073**
HAC-FR-79-73-999-VOL-1	N80-15399 *
HAC-REP-E2380-VOL-1	N80-15399 *
HAOS-16	N80-15673 *
HAOS-18	N80-15674 *
HAOS-19	N80-15697 *
HAOS-23	N80-15679 *
HAOS-24	N80-15696 *
HAOS-30	N80-15678 *
HAOS-31	N80-15680 *
HDL-CR-79-0448	N80-15951 *
HDL-TR-79-5	N80-15381 *
HDL-TR-1890	N80-15845 *
HDL-TR-1899	N80-15337 *
HONEYWELL-7804-5	N80-15381**
HPP-79-14	N80-15987 *
HSER-7001	N80-15107**
HSER-7002	N80-15117**
ID-12027-1	N80-15591 *
IFSM-TR-45	N80-15827 *
IMS-001/FE/1	N80-15420 *
INDEX-79-715-NOI	N80-15824 *
IS-M-195	N80-15248 *
IS-T-860	N80-15271 *
IS-T-861	N80-15889 *
ISBN-0-309-02846-9	N80-15306 *
ISBN-0-309-02848-5	N80-15305 *
ISBN-0-309-02953-8	N80-15999 *
ISBN-0-309-02954-6	N80-16000 *
ISBN-0-7988-1602-3	N80-15388 *
ISBN-0-7988-1615-5	N80-15379 *
ISBN-0-7988-1622-8	N80-15230 *
ISBN-0-96970-105-3	N80-15329 *
ISBN-92-835-0245-0	N80-15141 *
ISBN-92-835-0249-3	N80-15806 *
ISBN-92-835-0252-3	N80-15149 *
ISBN-92-835-1314-X	N80-15140 *
ISSN-0148-7191	N80-15060**
ISSN-0160-9742	N80-15981 *
JSC-16015-VOL-1	N80-15448**
JSC-16015-VOL-2	N80-15448**
JSC-16318	N80-15185**
JTCG/AS-78-T-004	N80-15841 *
K/CSD/TR-26	N80-15844 *
KAPTI-77-40	N80-15900 *
L-11608	N80-15031**
LA-TR-79-18	N80-15901 *
LA-TR-79-19	N80-15900 *
LA-UR-79-576	N80-15940 *
LA-UR-79-951	N80-15211 *
LA-UR-79-1039	N80-15912 *
LA-UR-79-1246	N80-15382 *
LA-UR-79-1598	N80-15643 *
LA-UR-79-1655	N80-15345 *
LA-UR-79-1687	N80-15945 *
LA-UR-79-1921	N80-16019 *
LA-UR-79-1954	N80-15324 *
LA-UR-79-2058	N80-15405 *
LA-UR-79-2176	N80-15400 *
LA-UR-79-2330	N80-15855 *
LA-UR-79-2344	N80-15934 *
LA-UR-79-2368	N80-15937 *
LA-5525-S-VOL-5	N80-15988 *
LA-7113-MS	N80-15402 *
LA-7517-MS	N80-15426 *
LA-7525-MS	N80-15751 *
LA-7538-MS	N80-15439 *
LA-7822	N80-15289 *
LA-7836-MS	N80-15857 *
LA-7866-IASE	N80-15565 *
LA-7879-MS	N80-15856 *
LA-7883-MS	N80-15718 *
LA-7899-MS	N80-15958 *
LA-7912-MS	N80-15905 *
LA-7935-MS	N80-15931 *
LA-7946-MS	N80-15820 *
LA-7980-PR	N80-15902 *
LBL-7070	N80-15618 *
LBL-8528	N80-15929 *
LBL-8570	N80-15911 *
LBL-8628	N80-15244 *
LBL-8703	N80-15568 *
LBL-8899	N80-15890 *
LBL-8946	N80-15210 *
LBL-9103	N80-15243 *
LBL-9160	N80-15802 *
LBL-9173	N80-15904 *
LBL-9465	N80-15921 *
LBL-9494	N80-15888 *
LBL-9504	N80-15859 *
LPL-9701	N80-15373 *
LC-79-18461	N80-15305 *
LC-79-600098	N80-15644 *
LC-79-600125	N80-15722 *
LC-79-600126	N80-15275 *
LC-79-607099	N80-15999 *
LC-79-607112	N80-16000 *
LG77ER0028	N80-15070**
LG77ER0028	N80-15071**
LG77ER0028	N80-15072**
LIDS-P-965	N80-15853**
LIDS-R-879	N80-15979 *
LPS-243	N80-15716 *

LR-28651-POL-1 ..... N80-15078*#
LR-28651-POL-2 ..... N80-15075*#

M-293 ..... N80-15065*#

MDC-J0519 ..... N80-15360 #

MITSG-79-15 ..... N80-15024 #

MLM-2564 ..... N80-15087 #

NRL-MR-22C ..... N80-15054 #

NPR-334524-1 ..... N80-15203*#

NPS/LIR/79-10 ..... N80-15901 #

NRC-SD-R-36 ..... N80-15951 #

NSI-79-TP-1603 ..... N80-15761 #

NTB-7-3-521 ..... N80-15181 #

NA-79-405 ..... N80-15073*#

NACA-TR-196 ..... N80-15041*#
NACA-TR-336 ..... N80-15036*#
NACA-TR-336 ..... N80-15037*#

NACA-116 ..... N80-15034*#
NACA-121 ..... N80-15038*#
NACA-164 ..... N80-15042*#
NACA-184 ..... N80-15039*#
NACA-191 ..... N80-15040*#
NACA-253 ..... N80-15043*#
NACA-323 ..... N80-15044*#
NACA-452 ..... N80-15046*#
NACA-496 ..... N80-15047*#

NADC-77015-30 ..... N80-15137 #
NADC-77166-30 ..... N80-15368 #
NADC-77167-30 ..... N80-15370 #
NADC-78103-60 ..... N80-15135 #
NADC-79213-60 ..... N80-15082 #

NASA-CP-2077 ..... N80-15127*#
NASA-CP-2110 ..... N80-15649*#

NASA-CR-3126 ..... N80-15663*#
NASA-CR-3217 ..... N80-15360*#
NASA-CR-3219 ..... N80-15363*#
NASA-CR-3222 ..... N80-15048*#
NASA-CR-3223 ..... N80-15049*#
NASA-CR-134669 ..... N80-15103*#
NASA-CR-134838 ..... N80-15123*#
NASA-CR-134839 ..... N80-15124*#
NASA-CR-134840 ..... N80-15113*#
NASA-CR-134841 ..... N80-15112*#
NASA-CR-134842 ..... N80-15111*#
NASA-CR-134848 ..... N80-15086*#
NASA-CR-134849 ..... N80-15083*#
NASA-CR-134850 ..... N80-15084*#
NASA-CR-134851 ..... N80-15085*#
NASA-CR-134852 ..... N80-15107*#
NASA-CR-134868 ..... N80-15088*#
NASA-CR-134872 ..... N80-15106*#
NASA-CR-134873 ..... N80-15101*#
NASA-CR-134890 ..... N80-15105*#
NASA-CR-134891 ..... N80-15102*#
NASA-CR-134914 ..... N80-15091*#
NASA-CR-134915 ..... N80-15089*#
NASA-CR-134916 ..... N80-15104*#
NASA-CR-134920 ..... N80-15090*#
NASA-CR-135000 ..... N80-15116*#
NASA-CR-135005 ..... N80-15109*#
NASA-CR-135010 ..... N80-15058*#
NASA-CR-135017 ..... N80-15087*#
NASA-CR-135046 ..... N80-15108*#
NASA-CR-135049 ..... N80-15114*#
NASA-CR-135075 ..... N80-15100*#
NASA-CR-135140 ..... N80-15117*#
NASA-CR-135160 ..... N80-15093*#
NASA-CR-135169 ..... N80-15099*#
NASA-CR-135249 ..... N80-15096*#
NASA-CR-135251 ..... N80-15097*#
NASA-CR-135266 ..... N80-15122*#
NASA-CR-135279 ..... N80-15110*#
NASA-CR-135296 ..... N80-15095*#

NASA-CR-135323 ..... N80-15125*#
NASA-CR-135325 ..... N80-15126*#
NASA-CR-135326 ..... N80-15118*#
NASA-CR-135337 ..... N80-15092*#
NASA-CR-135352 ..... N80-15119*#
NASA-CR-135354 ..... N80-15115*#
NASA-CR-144887 ..... N80-15073*#
NASA-CR-150696 ..... N80-15563*#
NASA-CR-152270 ..... N80-15065*#
NASA-CR-152279 ..... N80-15066*#
NASA-CR-156859 ..... N80-15046*#
NASA-CR-158926-POL-1 ..... N80-15074*#
NASA-CR-158926-POL-2 ..... N80-15075*#
NASA-CR-159122 ..... N80-15423*#
NASA-CR-159123 ..... N80-15424*#
NASA-CR-159134 ..... N80-15070*#
NASA-CR-159135 ..... N80-15071*#
NASA-CR-159136 ..... N80-15072*#
NASA-CR-159141 ..... N80-15052*#
NASA-CR-159175 ..... N80-15380*#
NASA-CR-159176 ..... N80-15062*#
NASA-CR-159178 ..... N80-15539*#
NASA-CR-159185 ..... N80-15205*#
NASA-CR-159199 ..... N80-15299*#
NASA-CR-159471 ..... N80-15094*#
NASA-CR-159473 ..... N80-15120*#
NASA-CR-159483 ..... N80-15121*#
NASA-CR-159674 ..... N80-15202*#
NASA-CR-159696 ..... N80-15559*#
NASA-CR-159706 ..... N80-15263*#
NASA-CR-159716 ..... N80-15130*#
NASA-CR-159718 ..... N80-15233*#
NASA-CR-159725 ..... N80-15553*#
NASA-CR-159739 ..... N80-15411*#
NASA-CR-159745 ..... N80-15264*#
NASA-CR-159753 ..... N80-15131*#
NASA-CR-159797 ..... N80-15300*#
NASA-CR-159951 ..... N80-16011*#
NASA-CR-159952 ..... N80-15308*#
NASA-CR-159953 ..... N80-15536*#
NASA-CR-159954 ..... N80-15381*#
NASA-CR-159955 ..... N80-15705*#
NASA-CR-160362 ..... N80-15538*#
NASA-CR-160428 ..... N80-15703*#
NASA-CR-160429 ..... N80-15186*#
NASA-CR-160430 ..... N80-15187*#
NASA-CR-160431 ..... N80-15188*#
NASA-CR-160432 ..... N80-15189*#
NASA-CR-160433 ..... N80-15190*#
NASA-CR-160434 ..... N80-15191*#
NASA-CR-160438 ..... N80-15307*#
NASA-CR-160440 ..... N80-15836*#
NASA-CR-160441 ..... N80-15199*#
NASA-CR-160442 ..... N80-15195*#
NASA-CR-161350 ..... N80-15203*#
NASA-CR-161351 ..... N80-15825*#
NASA-CR-161352 ..... N80-15948*#
NASA-CR-161353 ..... N80-15194*#
NASA-CR-161363 ..... N80-15706*#
NASA-CR-161368 ..... N80-16016*#
NASA-CR-161367 ..... N80-15412*#
NASA-CR-162392 ..... N80-15447*#
NASA-CR-162442 ..... N80-15526*#
NASA-CR-162443 ..... N80-15527*#
NASA-CR-162444 ..... N80-15528*#
NASA-CR-162445 ..... N80-16013*#
NASA-CR-162446 ..... N80-15529*#
NASA-CR-162447 ..... N80-15530*#
NASA-CR-162448 ..... N80-15531*#
NASA-CR-162449 ..... N80-15532*#
NASA-CR-162450 ..... N80-15533*#
NASA-CR-162464 ..... N80-15871*#
NASA-CR-162465 ..... N80-15870*#
NASA-CR-162467 ..... N80-16008*#
NASA-CR-162468 ..... N80-15362*#
NASA-CR-162566 ..... N80-16012*#
NASA-CR-162569 ..... N80-15058*#
NASA-CR-162570 ..... N80-15853*#
NASA-CR-162571 ..... N80-15215*#
NASA-CR-162572 ..... N80-15728*#
NASA-CR-162573 ..... N80-16014*#
NASA-CR-162574 ..... N80-15232*#
NASA-CR-162575 ..... N80-15873*#
NASA-CR-162576 ..... N80-15872*#
NASA-CR-162577 ..... N80-15869*#
NASA-CR-162578 ..... N80-15076*#
NASA-CR-162579 ..... N80-15707*#
NASA-CR-162581 ..... N80-15708*#
NASA-CR-162582 ..... N80-15201*#

NASA-CR-162583 ..... N80-16015*#
NASA-CR-162729 ..... N80-15063*#
NASA-CR-162730 ..... N80-15064*#
NASA-CR-162731 ..... N80-15065*#

NASA-RP-1045 ..... N80-15788*#
NASA-RP-1050 ..... N80-15033*#
NASA-RP-1055 ..... N80-15821*#
NASA-RP-1057 ..... N80-16009*#
NASA-RP-1058 ..... N80-15726*#

NASA-SP-7011(200) N80-15787*
NASA-SP-7037(115) N80-15027*

NASA-TM-73284 ..... N80-15727*#
NASA-TM-74106 ..... N80-15179*#
NASA-TM-75500 ..... N80-15708*#
NASA-TM-75697 ..... N80-15822*#
NASA-TM-75919 ..... N80-15637*#
NASA-TM-75925 ..... N80-15537*#
NASA-TM-75941 ..... N80-15700*#
NASA-TM-75951 ..... N80-15781*#
NASA-TM-75954 ..... N80-15798*#
NASA-TM-75955 ..... N80-15799*#
NASA-TM-75964 ..... N80-15782*#
NASA-TM-75973 ..... N80-15779*#
NASA-TM-75999 ..... N80-15778*#
NASA-TM-76004 ..... N80-15783*#
NASA-TM-76008 ..... N80-15973*#
NASA-TM-76013 ..... N80-15796*#
NASA-TM-76014 ..... N80-15797*#
NASA-TM-78253 ..... N80-15562*#
NASA-TM-78562 ..... N80-15067*#
NASA-TM-78627 ..... N80-15031*#
NASA-TM-79166 ..... N80-15059*#
NASA-TM-79290 ..... N80-15132*#
NASA-TM-79291 ..... N80-15422*#
NASA-TM-79301 ..... N80-15133*#
NASA-TM-79309 ..... N80-15235*#
NASA-TM-79310 ..... N80-15538*#
NASA-TM-80154 ..... N80-15050*#
NASA-TM-80174 ..... N80-15430*#
NASA-TM-80197 ..... N80-15874*#
NASA-TM-80200 ..... N80-15875*#
NASA-TM-80744 ..... N80-15974*#
NASA-TM-80811 ..... N80-15448*#
NASA-TM-80850 ..... N80-15185*#
NASA-TM-80851 ..... N80-15060*#
NASA-TM-80852 ..... N80-15980*
NASA-TM-81148 ..... N80-15854*#
NASA-TM-81380 ..... N80-15560*#
NASA-TM-81383 ..... N80-15204*#
NASA-TM-81386 ..... N80-15076*#
NASA-TM-81387 ..... N80-15554*#
NASA-TM-81388 ..... N80-15555*#
NASA-TM-81390 ..... N80-15556*#
NASA-TM-81391 ..... N80-15557*#
NASA-TM-81392 ..... N80-15558*#
NASA-TM-81393 ..... N80-15561*#
NASA-TM-81397 ..... N80-15200*#
NASA-TM-81406 ..... N80-15134*#
NASA-TM-81409 ..... N80-15051*#
NASA-TM-81410 ..... N80-15364*#
NASA-TM-81411 ..... N80-15365*#
NASA-TM-81776 ..... N80-16010*#

NASA-TP-1004 ..... N80-15129*#
NASA-TP-1431 ..... N80-15138*#
NASA-TP-1553 ..... N80-15535*#
NASA-TP-1586 ..... N80-15445*#
NASA-TP-1596 ..... N80-15068*#
NASA-TP-1597 ..... N80-15128*#
NASA-TP-1599 ..... N80-15410*#
NASA-TP-1600 ..... N80-15428*#
NASA-TP-1601 ..... N80-15069*#
NASA-TP-1602 ..... N80-15028*#
NASA-TP-1603 ..... N80-15361*#
NASA-TP-1604 ..... N80-15230*#

NATC-TM-79-2-SA ..... N80-15080 #

NBS-SP-400-58 ..... N80-15694 #
NBS-SP-500-52 ..... N80-15833 #
NBS-SP-556 ..... N80-15275 #
NBS-SP-557 ..... N80-15722 #

NBSIR-79-1612 ..... N80-15295 #
NBSIR-79-1736 ..... N80-15387 #
NBSIR-79-1792 ..... N80-16004 #

NBSIR-79-1909 ..... N80-15696 #

NCAR-TN-135+PROC ..... N80-15724 #
NCAR-TN-137+IA ..... N80-15779 #
NCAR-TN-139+STR ..... N80-15767 #
NCAR-TN-140+STR ..... N80-15923 #
NCAR-TN-141+STR ..... N80-15766 #

NEAR-TR-189 ..... N80-15049*#
NEAR-TR-193 ..... N80-15048*#

NEPRF-CR-79-02 ..... N80-15732 #

NEPRF-TR-79-03 ..... N80-15730 #
NEPRF-TR-79-04 ..... N80-15733 #

NHAB-353-2 ..... N80-15231 #

NHFI-10-1 ..... N80-15582 #
NHFI-37 ..... N80-15298 #
NHFI-42 ..... N80-15685 #

NOAA-S/T-78-211-VCL-7 ..... N80-15772 #

NOAA-TM-EDIS-27 ..... N80-15765 #

NOAA-TM-ERL-AOML-37 ..... N80-15543 #

NOAA-TM-ERL-APCL-22 ..... N80-15758 #

NOAA-TM-ERL-NSSL-87 ..... N80-15755 #

NOAA-TM-ERL-WPL-92 ..... N80-15757 #

NOAA-TM-NOS-22 ..... N80-15386 #
NOAA-TM-NOS-25 ..... N80-15546 #

NOAA-TM-NWS-PCST-23 ..... N80-15764 #

NOAA-TM-NWS-PR-20 ..... N80-15754 #

NOAA-TM-NWS-WR-140 ..... N80-15762 #

NOAA-TR-NESS-79 ..... N80-15759 #

NOAA-TR-NWFS-SSRP-730 ..... N80-15776 #

NOAA-TR-NWS-20-VOL-2 ..... N80-15753 #

NOAA-79070205 ..... N80-15777 #
NOAA-79070603 ..... N80-15762 #
NOAA-79071102 ..... N80-15776 #
NOAA-79071203 ..... N80-15386 #
NOAA-79072309 ..... N80-15546 #
NOAA-79072310 ..... N80-16021 #
NOAA-79080802 ..... N80-15760 #
NOAA-79080904 ..... N80-15757 #
NOAA-79080909 ..... N80-15824 #
NOAA-79081001 ..... N80-15756 #
NOAA-79081002 ..... N80-15543 #
NOAA-79081401 ..... N80-15759 #
NOAA-79081403 ..... N80-15758 #
NOAA-79081601 ..... N80-15755 #
NOAA-79082005 ..... N80-15754 #
NOAA-79082201 ..... N80-15753 #
NOAA-79083002 ..... N80-15765 #

NOSC/TD-265 ..... N80-15339 #
NOSC/TD-275 ..... N80-15330 #

NPS63-79-002 ..... N80-15730 #
NPS69-79-005 ..... N80-15392 #

NRL-MR-4035 ..... N80-15397 #
NRL-MR-4092 ..... N80-15926 #

NRL-8307 ..... N80-16018 #

NSF/IDOR-79-59 ..... N80-15768 #
NSF/IDOE/CUEA/TR-52 ..... N80-15768 #
NSF/INT-15160 ..... N80-15328 #
NSF/PRA-7703286 ..... N80-15978 #
NSF/RA-780616 ..... N80-15297 #
NSF/RA-790047 ..... N80-15998 #
NSF/RA-790053 ..... N80-16005 #
NSF/RA-790103 ..... N80-15979 #
NSF/RA-790128 ..... N80-15725 #
NSF/RA-790147 ..... N80-15261 #

BSWC/DL-TR-3719 ..... NPD-15193 #
BSWC/DL-TR-3778 ..... NPD-15192 #
BSWC/TR-79-51 ..... NSO-15266 #

WTIS/PS-74/102 ..... NPO-15832 #
WTIS/PS-75/000 ..... NSO-15752 #
WTIS/PS-75/045 ..... NSO-15721 #
WTIS/PS-75/060 ..... NSO-15671 #
WTIS/PS-75/068 ..... NSO-15542 #
WTIS/PS-75/412 ..... NSO-15327 #
WTIS/PS-75/420 ..... NSO-15924 #
WTIS/PS-75/513 ..... NSO-15990 #
WTIS/PS-75/530 ..... NSO-15260 #
WTIS/PS-75/572 ..... NPO-15832 #
WTIS/PS-75/588 ..... NSO-15850 #
WTIS/PS-75/641 ..... NSO-15721 #
WTIS/PS-75/668 ..... NSO-15542 #
WTIS/PS-75/670 ..... NSO-15409 #
WTIS/PS-75/761 ..... NSO-15752 #
WTIS/PS-75/762 ..... NSO-15671 #
WTIS/PS-76/0490 ..... NSO-15924 #
WTIS/PS-76/0511 ..... NSO-15327 #
WTIS/PS-76/0645 ..... NSO-15260 #
WTIS/PS-76/0673 ..... NSO-15832 #
WTIS/PS-76/0698 ..... NSO-15721 #
WTIS/PS-76/0705 ..... NSO-15752 #
WTIS/PS-76/0714 ..... NSO-15542 #
WTIS/PS-76/0733 ..... NSO-15671 #
WTIS/PS-76/0747 ..... NSO-15850 #
WTIS/PS-76/0755 ..... NSO-15990 #
WTIS/PS-76/C776 ..... NSO-15325 #
WTIS/PS-76/0843 ..... NSO-15409 #
WTIS/PS-77/0581 ..... NSO-15924 #
WTIS/PS-77/0591 ..... NSO-15327 #
WTIS/PS-77/0755 ..... NSO-15832 #
WTIS/PS-77/0786 ..... NSO-15671 #
WTIS/PS-77/0803 ..... NSO-15269 #
WTIS/PS-77/0815 ..... NSO-15721 #
WTIS/PS-77/0816 ..... NPO-15418 #
WTIS/PS-77/0817 ..... NSO-15990 #
WTIS/PS-77/0831 ..... NSO-15409 #
WTIS/PS-77/0857 ..... NSO-15752 #
WTIS/PS-77/0861 ..... NSO-15274 #
WTIS/PS-77/0864 ..... NSO-15850 #
WTIS/PS-77/0867 ..... NSO-15542 #
WTIS/PS-77/0895 ..... NSO-15325 #
WTIS/PS-77/0892 ..... NSO-15976 #
WTIS/PS-78/0714 ..... NSO-15924 #
WTIS/PS-78/0873 ..... NSO-15327 #
WTIS/PS-78/0916 ..... NSO-15721 #
WTIS/PS-78/0930 ..... NSO-15671 #
WTIS/PS-78/0935 ..... NPO-15832 #
WTIS/PS-78/0938 ..... NSO-15752 #
WTIS/PS-78/0948 ..... NSO-15274 #
WTIS/PS-78/0963 ..... NSO-15850 #
WTIS/PS-78/0965 ..... NSO-15542 #
WTIS/PS-78/0970 ..... NSO-15260 #
WTIS/PS-78/0976 ..... NSO-15976 #
WTIS/PS-78/0979 ..... NSO-15990 #
WTIS/PS-78/0983 ..... NSO-15325 #
WTIS/PS-78/0984 ..... NSO-15418 #
WTIS/PS-78/0992 ..... NSO-15409 #
WTIS/PS-79/0958/3 ..... NSO-15976 #
WTIS/PS-79/0971/6 ..... NSO-15990 #
WTIS/PS-79/0972/4 ..... NSO-15752 #
WTIS/PS-79/0973/2 ..... NSO-15671 #
WTIS/PS-79/0978/1 ..... NSO-15832 #
WTIS/PS-79/0979/9 ..... NSO-15850 #
WTIS/PS-79/0981/5 ..... NSO-15409 #
WTIS/PS-79/0984/9 ..... NSO-15260 #
WTIS/PS-79/0989/8 ..... NSO-15721 #
WTIS/PS-79/0993/0 ..... NSO-15542 #
WTIS/PS-79/0998/9 ..... NSO-15327 #
WTIS/PS-79/1006/0 ..... NSO-15924 #
WTIS/PS-79/1013/6 ..... NSO-15325 #
WTIS/PS-79/1018/5 ..... NSO-15326 #
WTIS/PS-79/1028/4 ..... NSO-15418 #
WTIS/PS-79/1032/6 ..... NSO-15274 #

WUREG-CR-0368 ..... NPO-15253 #
WUREG-CR-0782 ..... NSO-15376 #

WUSC-TR-6099 ..... NSO-15826 #

WVL-0059-009 ..... NRO-15342 #

WWC-TR-3475 ..... NSO-15312 #

ORD-CR-215-259-1F ..... NSO-15139 #
CRD-CR-290-005-2F ..... NSO-15369 #

CPPORTUNITY-BRIEF-14 ..... NSO-15824 #

ORAP-158 ..... NSO-15670 #

OBC-79-1 ..... NSO-15719 #

CRNL-5220 ..... NSO-15359 #

OENL/CON-23 ..... NSO-15619 #
CENL/TMG/TR-14 ..... NSO-15581 #
OENL/SUB-7967-1 ..... NSO-15895 #
OENL/SUB-7322-1 ..... NSO-15441 #
CENL/TR-63-2 ..... NSO-15625 #
OENL/TR-5969 ..... NSO-15440 #
CENL/TR-6465 ..... NSO-15252 #
OENL/TR-6485 ..... NSO-15226 #
CENL/TR-6531 ..... NSO-15877 #
OENL/TR-6563 ..... NSO-15224 #
OENL/TR-6622 ..... NSO-15620 #
OENL/TR-7020 ..... NSO-15879 #

OBO-3106-71 ..... NSO-15222 #
ORO-3861-28 ..... NSO-15217 #
CRO-4837-6 ..... NSO-15967 #
ORO-5223-12 ..... NSO-15885 #
CRC-5446-1 ..... NSO-15603 #
ORO-5523-T1 ..... NSO-15590 #

OSORP-761251/711 ..... NSO-15433 #

OO-A99E-79-101 ..... NPO-15208 #

OWRT-B-011-CONN(1; ..... NSO-15694 #
OWRT-B-060-NY(1) ..... NSO-15785 #
OWRT-B-089-NC(8) ..... NSO-15552 #

OWRT-B-0064-7814-2 ..... NSO-16002 #

PATR-1034-79-3 ..... NSO-15823 #

PB-297583/7 ..... NSO-15420 #
PB-297931/8 ..... NSO-15547 #
PB-298057/1 ..... NSO-15387 #
PB-298296/5 ..... NSO-15998 #
PB-298343/5 ..... NSO-15683 #
PB-298465/6 ..... NSO-15684 #
PB-298872/3 ..... NSO-15723 #
PB-298879/8 ..... NSO-15692 #
PB-298900/2 ..... NSO-15762 #
PB-298997/8 ..... NSO-15769 #
PB-298998/6 ..... NSO-15978 #
PB-299015/8 ..... NSO-15690 #
PB-299016/6 ..... NSO-15777 #
PB-299026/5 ..... NSO-15770 #
PB-299027/3 ..... NSO-16002 #
PB-299070/3 ..... NSO-15551 #
PB-299078/6 ..... NSO-15776 #
PB-299097/6 ..... NSO-15689 #
PB-299100/8 ..... NSO-15691 #
PB-299168/5 ..... NSO-15419 #
PB-299183/4 ..... NSO-15688 #
PB-299195/8 ..... NSO-15672 #
PB-299212/1 ..... NSO-15695 #
PB-299215/4 ..... NSO-15686 #
PB-299238/6 ..... NSO-15685 #
PB-299271/7 ..... NSO-15645 #
PB-299276/6 ..... NSO-15977 #
PB-299321/0 ..... NSO-15546 #
PB-299325/1 ..... NSO-15687 #
PB-299338/4 ..... NSO-16001 #
PB-299340/0 ..... NSO-16020 #
PB-299354/1 ..... NSO-15550 #
PB-299358/2 ..... NSO-15675 #
PB-299361/6 ..... NSO-15295 #
PB-299362/4 ..... NSO-15771 #
PB-299399/6 ..... NSO-15682 #
PB-299428/3 ..... NSO-15775 #
PB-299439/0 ..... NSO-15722 #
PB-299442/4 ..... NSO-15061 #
PB-299448/2 ..... NSO-15304 #
PB-299524/9 ..... NSO-15328 #
PB-299536/3 ..... NPO-15548 #
PB-299549/6 ..... NSO-15761 #
PB-299559/5 ..... NSO-15545 #
PB-299568/6 ..... NSO-15544 #

FB-299575/1 ..... NBS-15294 #
FB-299629/6 ..... NBS-15674 #
FB-299632/0 ..... NBS-15678 #
FB-299633/8 ..... NBS-15680 #
FB-299634/6 ..... NBS-15696 #
FB-299635/3 ..... NBS-15679 #
FB-299636/1 ..... NBS-15673 #
FB-299643/7 ..... NBS-15697 #
FB-299694/0 ..... NBS-16021 #
FB-299733/6 ..... NBS-15992 #
FB-299740/1 ..... NBS-16006 #
FB-299859/9 ..... NBS-15698 #
FB-299878/9 ..... NBS-15756 #
FB-299883/9 ..... NBS-15824 #
FB-299895/3 ..... NBS-15306 #
FB-299896/1 ..... NBS-15305 #
FB-299905 ..... NBS-15379 #
FB-299928/2 ..... NBS-15699 #
FB-299934/0 ..... NBS-15552 #
FB-299936/5 ..... NBS-15308 #
FB-299951/4 ..... NBS-15275 #
FB-299953/0 ..... NBS-15694 #
FB-299959/7 ..... NBS-15700 #
FB-299964/7 ..... NBS-15684 #
FB-299968/8 ..... NBS-15228 #
FB-299972/0 ..... NBS-15757 #
FB-300297/9 ..... NBS-15543 #
FB-300299/5 ..... NBS-15760 #
FB-300327/4 ..... NBS-15677 #
FB-300337/3 ..... NBS-15701 #
FB-300339/9 ..... NBS-15763 #
FB-300375/3 ..... NBS-15681 #
FB-300383/7 ..... NBS-15676 #
FB-300436/3 ..... NBS-15261 #
FB-300440/5 ..... NBS-16007 #
FB-300443/9 ..... NBS-15702 #
FB-300446/2 ..... NBS-15693 #
FB-300459/5 ..... NBS-15805 #
FB-300468/6 ..... NBS-15833 #
FB-300477/7 ..... NBS-15230 #
FB-300481/9 ..... NBS-15229 #
FB-300491/8 ..... NBS-16004 #
FB-300533/7 ..... NBS-15262 #
FB-300589/8 ..... NBS-16003 #
FB-300615/2 ..... NBS-15231 #
FB-300631/9 ..... NBS-15786 #
FB-300692/1 ..... NBS-15946 #
FB-300715/0 ..... NBS-15764 #
FB-300720/0 ..... NBS-15758 #
FB-300721/8 ..... NBS-15306 #
FB-300747/3 ..... NBS-16000 #
FB-300749/9 ..... NBS-15999 #
FB-300754/9 ..... NBS-15759 #
FB-300790/3 ..... NBS-15754 #
FB-300825/7 ..... NBS-15549 #
FB-300865/3 ..... NBS-15755 #
FB-300870/3 ..... NBS-15753 #
FB-300904/0 ..... NBS-15804 #
FB-300947/9 ..... NBS-15991 #
FB-301008/5 ..... NBS-15647 #
FB-301063/4 ..... NBS-15803 #
FB-301104/6 ..... NBS-15296 #
FB-301116/0 ..... NBS-15725 #
FB-301201/0 ..... NBS-15785 #
FB-301218/4 ..... NBS-15979 #
FB-301220/0 ..... NBS-16005 #
FB-301240/8 ..... NBS-15760 #
FB-301256/4 ..... NBS-15297 #
FB-301263/0 ..... NBS-15765 #
FB-301297/8 ..... NBS-15724 #
FB-301309/1 ..... NBS-15646 #
FB-301343/0 ..... NBS-15766 #
FB-301367/5 ..... NBS-15066 #
FB-301387/7 ..... NBS-15767 #
FB-301388/5 ..... NBS-15923 #
FB-301390/1 ..... NBS-15298 #
FB-310245/7 ..... NBS-15648 #

FD/RB-78/106R ..... NBS-15680 #

FI-FR-900 ..... NBS-15319 #
FI-FR-1052 ..... NBS-15343 #

FNL-2743 ..... NBS-15903 #

FPG-422 ..... NBS-15935 #

FPPL-1555 ..... NBS-15907 #
FPPL-1562 ..... NBS-15936 #

FPPL-1564 ..... NBS-15941 #

FR-1 ..... NBS-15527*#
FR-9 ..... NBS-15293 #
FR-345 ..... NBS-15837*#

FRC-706-22 ..... NBS-15982 #

FREPRINT-42 ..... NBS-15822*#

FRF-8681 ..... NBS-15296 #

GEI-REPORT-9413 ..... NBS-15989 #

GR-1 ..... NBS-15591 #
GR-2 ..... NBS-15277 #
GR-2 ..... NBS-15333 #

H-6132 ..... NBS-15062*#

HADC-TR-79-100 ..... NBS-15318 #
HADC-TR-79-102 ..... NBS-15986 #
HADC-TR-79-182 ..... NBS-15332 #
HADC-TR-79-189 ..... NBS-15954 #
HADC-TR-79-204 ..... NBS-15309 #

HAI-111 ..... NBS-15331 #

HAR-EI-74-2-4 ..... NBS-15329 #

HEPT-1 ..... NBS-15770 #
HEPT-2EI ..... NBS-15916 #
HEPT-3 ..... NBS-15393 #
HEPT-3-RH-IR-79-1 ..... NBS-15744 #
HEPT-78/293 ..... NBS-15687 #
HEPT-79-SM-4 ..... NBS-15725 #
HEPT-79-4 ..... NBS-15769 #
HEPT-79-9B9-BOBBI-B1 ..... NBS-15237 #
HEPT-79#V013 ..... NBS-15825*#
HEPT-80-FR-3 ..... NBS-15185*#
HEPT-003-79 ..... NBS-15536*#

HFP-TRANS-273 ..... NBS-15289 #

HFP-2645 ..... NBS-15257 #

HI/RD79-217 ..... NBS-15202*#

HLC-2227-T22-13 ..... NBS-15293 #

HPI-CS-79-3 ..... NBS-15431 #
HPI-CS-79-4 ..... NBS-15240 #

HP-77-22 ..... NBS-15329 #

HTI/1456/00-01F ..... NBS-15674 #
HTI/1623/00-07F ..... NBS-15673 #

I74AEG479-VOL-1 ..... NBS-15123*#
I74AEG479-VOL-2 ..... NBS-15124*#
I75AEG213 ..... NBS-15111*#
I75AEG252-VOL-1 ..... NBS-15083*#
I75AEG252-VOL-2 ..... NBS-15084*#
I75AEG252-VOL-3 ..... NBS-15085*#
I75AEG278 ..... NBS-15113*#
I75AEG349 ..... NBS-15088*#
I75AEG368 ..... NBS-15102*#
I75AEG381 ..... NBS-15112*#
I75AEG443 ..... NBS-15086*#
I75AEG444 ..... NBS-15091*#
I75AEG445 ..... NBS-15087*#
I75AEG449 ..... NBS-15104*#
I75AEG483 ..... NBS-15090*#
I75AEG484 ..... NBS-15109*#
I75AEG511 ..... NBS-15093*#
I76AEG218 ..... NBS-15114*#
I76AEG222 ..... NBS-15116*#
I76AEG233 ..... NBS-15098*#
I76AEG379-1 ..... NBS-15122*#
I76AEG420 ..... NBS-15100*#
I77AEG177 ..... NBS-15108*#
I77AEG212-VOL-3 ..... NBS-15097*#
I77AEG300 ..... NBS-15099*#
I77AEG305 ..... NBS-15095*#
I77AEG327 ..... NBS-15101*#
I77AEG398 ..... NBS-15115*#
I77AEG439 ..... NBS-15110*#
I77AEG473-VOL-1 ..... NBS-15125*#
I77AEG475-VOL-3 ..... NBS-15126*#

P77AEGA76-VOL-4 ..... N80-15118*#
P77AFG588 ..... N80-15119*#
P77AEG664 ..... N80-15052*#
P77AFG2121-VOL-1 ..... N80-15096*#
P78AEG573-VOL-1 ..... N80-15094*#
P79AFG397 ..... N80-15121*#
P79AEG478 ..... N80-15120*#
P7911-4 ..... N80-15307*#

S-487 ..... N80-15788*#
S-489 ..... N80-15649*#
S-492 ..... N80-15535*#

SAC-10 ..... N80-15911 #

SAI-79-807-WA ..... N80-15749 #
SAI-79-800-WA ..... N80-15748 #

SAMSO-TR-79-81 ..... N80-15969 #
SAMSO-TR-79-94 ..... N80-16017 #

SAR-0030-T4 ..... N80-15966 #
SAR-0030-T5 ..... N80-15354 #
SAR-0115-T1 ..... N80-15276 #
SAR-1331-T1 ..... N80-15596 #
SAR-1331-T2 ..... N80-15636 #

SAND-78-0326 ..... N80-15347 #
SAND-78-0422 ..... N80-15442 #
SAND-78-0958C ..... N80-15600 #
SAND-78-0983 ..... N80-15585 #
SAND-78-1315-REV ..... N80-15575 #
SAND-78-1382 ..... N80-15253 #
SAND-78-1541 ..... N80-15878 #
SAND-78-1865C ..... N80-15624 #
SAND-78-1866C ..... N80-15273 #
SAND-78-1918 ..... N80-15617 #
SAND-78-1941C ..... N80-15416 #
SAND-78-1957C ..... N80-15996 #
SAND-78-1999C ..... N80-15623 #
SAND-78-2186C ..... N80-15566 #
SAND-78-2187C ..... N80-15578 #
SAND-78-7049 ..... N80-15622 #
SAND-78-8271 ..... N80-15377 #
SAND-78-8511 ..... N80-15601 #
SAND-79-0422 ..... N80-15574 #
SAND-79-0487 ..... N80-15608 #
SAND-79-0592C ..... N80-15270 #
SAND-79-0598C ..... N80-15355 #
SAND-79-0738C ..... N80-15288 #
SAND-79-0787 ..... N80-15641 #
SAND-79-0834 ..... N80-15607 #
SAND-79-0933C ..... N80-15908 #
SAND-79-1150C ..... N80-15964 #
SAND-79-1165C ..... N80-15577 #
SAND-79-1240C ..... N80-15956 #
SAND-79-1246C ..... N80-15627 #
SAND-79-1602C ..... N80-15637 #
SAND-79-1715C ..... N80-15965 #
SAND-79-7023 ..... N80-15586 #
SAND-79-8243 ..... N80-15861 #
SAND-79-8508 ..... N80-15602 #
SAND-79-8679 ..... N80-15374 #

SAR-1 ..... N80-15569 #
SAR-2 ..... N80-15233*#
SAR-4 ..... N80-15131*#
SAR-6 ..... N80-15130*#
SAR-8 ..... N80-15915 #
SAR-37 ..... N80-15076*#
SAR-79-10065-01 ..... N80-15340 #

SATR-6 ..... N80-15382 #

SC5169.16PR ..... N80-15236 #

SERI/RR-34-152 ..... N80-15570 #
SERI/RR-36-306 ..... N80-15579 #
SERI/RR-54-164 ..... N80-15583 #
SERI/TP-34-180 ..... N80-15571 #
SERI/TP-52-138 ..... N80-15639 #

SETEC-RMP-79-61 ..... N80-15233*#

SGD-418-PT-1 ..... N80-16021 #
SGD-418-PT-2 ..... N80-16020 #

SLAC-PUB-2307 ..... N80-15831 #
SLAC-PUB-2362 ..... N80-15883 #
SLAC-PUB-2373 ..... N80-15890 #

SLAC-TN-79-2 ..... N80-15353 #

SLAC-216 ..... N80-15891 #

SP-1 ..... N80-15661 #
SR-1 ..... N80-15712 #

SRC-TR-555.20 ..... N80-15647 #

SS-DAR-79-3 ..... N80-15207 #

SS-GL-3008 ..... N80-15919 #

SS-RMT-23 ..... N80-15363*#

SS-JIAA-TR-2 ..... N80-15871*#
SS-JIAA-TR-3 ..... N80-15362*#
SS-JIAA-TR-5 ..... N80-15870*#
SS-JIAA-TP-7 ..... N80-15215*#
SS-JIAA-TR-12 ..... N80-15869*#
SS-JIAA-TR-16 ..... N80-15872*#
SS-JIAA-TR-20 ..... N80-15873*#
SS-STAR-CS-79-722 ..... N80-15985 #
SS-STAR-CS-79-739 ..... N80-15987 #

SS-TR-19 ..... N80-15707*#

SWRI-02-4268 ..... N80-15435 #

TAE-349 ..... N80-15032 #
TAE-350 ..... N80-15214 #
TAE-351 ..... N80-15835 #
TAE-352 ..... N80-15834 #
TAE-360 ..... N80-15427 #

TAED-79-7 ..... N80-15699 #

TE-1609 ..... N80-15549 #

TI-0798-05-02 ..... N80-15038 #

TID-4500-R66 ..... N80-15257 #
TID-28848-DRAFT ..... N80-15287 #

TI79-5 ..... N80-15261 #

TM-71 ..... N80-15063*#
TM-72 ..... N80-15064*#
TM-73 ..... N80-15065*#

TN-1979-38 ..... N80-15196 #
TN-1979-52 ..... N80-15920 #

TOP-7-3-521 ..... N80-15181 #
TOP-7-3-528 ..... N80-15078 #

TR-1 ..... N80-15389 #
TR-2 ..... N80-15210 #
TR-2 ..... N80-15916 #
TR-3 ..... N80-15922 #
TR-4A ..... N80-15208 #
TR-7 ..... N80-15949 #
TR-9 ..... N80-15955 #
TR-25 ..... N80-15239 #
TR-78/503 ..... N80-16007 #
TR-79-1 ..... N80-15867 #
TR-79-11 ..... N80-15320 #
TR-167 ..... N80-15975 #
TR-0079-4981-01-1 ..... N80-15969 #
TR-0079-4960-05-5 ..... N80-16017 #

TRR/TRR-697 ..... N80-15306 #
TRR/TRP-700 ..... N80-15305 #
TRR/TRR-707 ..... N80-15999 #
TRR/TRR-708 ..... N80-16000 #

TRRR-1357 ..... N80-15909 #

TRW-28815-H011-R0-00 ..... N80-15836*#
TRW-31782-6082-RB-00 ..... N80-15264*#

UCID-18125 ..... N80-15894 #
UCID-19152 ..... N80-15256 #
UCID-18153-REV-1 ..... N80-15564 #
UCID-18167 ..... N80-15881 #

UCRL-13975 ..... N80-15357 #

UCRL-15033	WBO-15930 #
UCRL-15046	WBO-15886 #
UCRL-15050	WBO-15182 #
UCRL-15051	WBO-15183 #
UCRL-15053	WBO-15628 #
UCRL-15084	WBO-15719 #
UCRL-15087	WBO-15633 #
UCRL-52496-VOL-1	WBO-15626 #
UCRL-52522	WBO-15896 #
UCRL-52548	WBO-15668 #
UCRL-52553-VOL-2	WBO-15995 #
UCRL-52561	WBO-15219 #
UCRL-52577	WBO-15212 #
UCRL-52614	WBO-15303 #
UCRL-52618	WBO-15610 #
UCRL-52628	WBO-15292 #
UCRL-52668	WBO-15849 #
UCRL-52796	WBO-15899 #
UCRL-81693	WBO-15933 #
UCRL-81772	WBO-15612 #
UCRL-81842	WBO-15213 #
UCRL-81907	WBO-15928 #
UCRL-81992	WBO-15910 #
UCRL-82028	WBO-15720 #
UCRL-82102	WBO-15939 #
UCRL-82441	WBO-15282 #
UCRL-82473	WBO-15408 #
UCRL-82481	WBO-15944 #
UCRL-82488	WBO-15272 #
UCRL-82538	WBO-15358 #
UCRL-82539	WBO-15407 #
UCRL-82556	WBO-15666 #
UCRL-82661	WBO-15938 #
UCRL-82684	WBO-15401 #
UCRL-82801	WBO-15375 #
UCRL-83019	WBO-15378 #
UCPL-83020	WBO-15437 #
UCRL-83043	WBO-15632 #
UKY-TR111-79-EM17	WBO-15136 #
UNC-WRRI-144	WBO-15552 #
USAFETAC/DS-79/051	WBO-15734 #
USARTL-TR-79-19	WBO-15079 #
USARTL-TR-79-26	WBO-15081 #
USCG-D-54-79	WBO-15830 #
USGS/WRD/WRI-79/029	WBO-15690 #
USGS/WRD/WRI-79/035	WBO-15677 #
USGS/WRD/WPI-79/046	WBO-15698 #
USGS/WRI-79/5	WBO-15550 #
USGS/WRI-79/27	WBO-15690 #
USGS/WRI-79/45	WBO-15677 #
USGS/WRI-79/64	WBO-15698 #
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